



MEMORANDUM

Comfort Lake-Forest Lake Watershed District

Date: September 19, 2023
To: CLFLWD Board of Managers
From: Mike Kinney, District Administrator
Subject: Floodplain Vulnerability Assessment Scope of Work



District Wide

Introduction

The purpose of this agenda item is to provide the Board with an update on the floodplain vulnerability assessment initiative and consider authorizing the first two tasks associated with this project. Unexpected staff turnover at one of our partner organizations, Freshwater Society, necessitates additional coordination prior to assigning a dollar amount to EOR's work for Task 3 (see task details below).

Background

District staff received a scope of work from EOR earlier this week. The scope is based on the work plan that had been previously developed and includes four tasks:

Task 1, Develop the Flood Risk Index: This is technical work led by EOR and entails developing a numerical ranking of flood risk from 0 (lowest risk) to 5 (highest risk). Flood Risk is determined by considering *hazard* (impacts that may cause loss of life, damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources), *economic vulnerability* (the presence of people, ecosystems, infrastructure or economic, social or cultural assets in places that could be flooded) and *social vulnerability* (the propensity to being adversely affected including susceptibility to harm and lack of capacity to cope and adapt).

EOR Cost: \$11,819

Task 2, Conduct Flood Risk Assessment: This task will use the flood risk maps developed under Task 1, along with the District's newly updated H&H model, to evaluate impacts to critical infrastructure, environmental features and social systems to identify specifically how these features are vulnerable to flooding (e.g., at what frequency, to what degree) in order to identify specific mitigation opportunities.

EOR Cost: \$16,676

Task 3, Community Resilience Building Workshops: Following Tasks 1 and 2, District Staff will share this information with the CLFLWD Board Managers for additional refinement. Following this refinement, EOR staff and Freshwater staff (if possible) will



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host two workshops with member communities, Washington County, Chisago County, state agency representatives, and local non-profits that represent at-risk populations. The workshops will follow the Community Resilience Building (CRB) process developed by The Nature Conservancy. [In the time between work plan development and now, Freshwater Society has experienced turnover in the two positions that were slated to be incorporated into our work plan. As such, staff will need to reconnect with Freshwater and identify if/how these gaps can be filled.]

EOR Cost: TBD pending Freshwater Society staff availability

Task 4, Final Report and Project Deliverables: EOR will summarize the steps taken to conduct the Flood Risk Assessment in a technical memorandum to the CLFLWD Board of Managers. It is assumed that District Staff will use the results of this assessment to explore and define the roles and responsibilities of the CLFLWD in flood management moving forward.

EOR Cost: \$6,465

Funding

The District has sought grant funding for this effort via two separate applications to MN Pollution Control Agency's Resiliency Planning grant program. Staff has also inquired with MN Department of Natural Resources about the DNR's Flood Hazard Mitigation grant program, but DNR staff indicated the program does not have funding for studies (if and when a capital improvement project is identified in the future, the District can apply to this program for capital project engineering, design and construction).

The District may choose to fund this effort from its reserve fund/levy funds in order to advance the work in a timely manner. The associated budget line item is 3-012-B.

Recommended Motion

The combined total of Tasks 1 and 2 is \$28,495.

Manager _____ moves to authorize the administrator, on advice of counsel, to enter into an agreement with EOR in accordance with the September 20, 2023 scope of work for Tasks 1 and 2, and in an amount not to exceed \$28,495. Seconded by Manager _____.

Attached

EOR Draft Floodplain Vulnerability Assessment Scope of Work

CLFLWD FLOOD RISK ASSESSMENT

Date	09/20/2023
To / Contact info	CLFLWD Board of Managers; Mike Kinney, Administrator; Emily Heinz, Planning Coordinator
From / Contact info	Camilla Correll, PE; Mike Talbot, CFM
Regarding	Flood Risk Assessment Scope of Work

Background

This watershed management project is designed to address stormwater management and localized flooding as well as to better understand infrastructural, environmental and socioeconomic impacts related to climate change in an effort to increase resilience collaboratively with member communities. As a result, this project will assess vulnerabilities and plan for the effects of Minnesota’s changing climate by identifying: (1) how to increase resilience to stormwater and reduce localized flood risk and (2) how to reduce human health effects and adapt community services, ordinances, and public spaces to the changing climate. By conducting a Flood Risk Assessment, the CLFLWD will be applying a consistent, unbiased, and cost-effective approach to this planning process. The outcome will be a flood risk assessment that highlights the hazards and vulnerabilities within the Comfort Lake-Forest Lake Watershed District. This assessment will inform the need for future model refinements as well as components of CLFLWD’s flood protection programs.

The Comfort Lake-Forest Lake WD has developed a number of tools which can be used to complete a flood risk assessment. First and foremost, the WD has a recently updated a set of detailed hydrologic and hydraulic models (SWMM) for each of the major drainage areas comprising the watershed. These models can be used to simulate the amount of runoff generated on the landscape and how quickly it travels via the local drainage system to downstream waterbodies. In addition, the WD developed a Flood Hazard Layer using a terrain (GIS) based analysis to inform the extent of a proposed greenway corridor that is being established to provide storage and flood control across the watershed. The CLFLWD would like to use these tools to conduct a Flood Risk Assessment that will identify areas more vulnerable to flooding so that they can engage member communities in assessing risk and the need for future model refinements and/or flood protection and/or mitigation improvement projects.

In addition to this technical work, the Comfort Lake-Forest Lake WD has identified vulnerable and/or under-served communities that warrant consideration in this flood risk assessment. When preparing communities for climate adaptation, it is vital to direct attention to areas with the greatest vulnerability, but also to those places that have the greatest opportunity to support vulnerable communities. The CLFLWD is located along the eastern border of Minnesota and overlaps with the Twin Cities Metropolitan Area (TCMA), at the peri-urban interface. According to the Social Vulnerability Index (SVI), socioeconomic, household composition & disability, and housing & transportation vulnerabilities are present across Forest Lake, Stillwater, and Wyoming. While these are important, what makes this area a key ally for environmental justice is its role in supporting the land and water resource needs of vulnerable communities across the TCMA. The peri-urban interface is a unique area for climate adaptation because it requires partnerships across urban and rural landscapes to establish a capacity for resource protection and allocation, especially in times of disaster. More specifically, peri-urban agriculture has proven to be an important tool for addressing issues of food security, while also contributing to climate adaptation and mitigation. An example of this is Big River Farms in Scandia, MN. It is a 150-acre incubator farm operated by 40+ emerging farmers, all growing USDA certified organic vegetables for distribution to farmers’ markets, wholesale markets (i.e., schools and hospitals), and CSAs. The food distributed by this collective group of farmers largely serves vulnerable communities across the Twin Cities Metro Area (TCMA), while

also offering land and market access and education in organic agriculture for immigrants, refugees, people of color, and others who have historically faced discrimination in accessing these resources. This flood risk assessment will consider the impact of flooding on a range of at-risk communities in order to define a more resilient and equitable flood protection plan and program.

Project Summary

First, the proposed project will evaluate **hazard** (impacts that may cause loss of life, damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources), **economic vulnerability** (the presence of people, ecosystems, infrastructure or economic, social or cultural assets in places that could be flooded) and **social vulnerability** (the propensity to being adversely affected including susceptibility to harm and lack of capacity to cope and adapt) using an emergent GIS methodology. This low-cost, high-benefit process uses terrain and landscape characteristics to develop a set of continuous maps showing hazard, economic vulnerability, and social vulnerability across the watershed, and, through combining these layers, a final map showing the **risk index** at every point in the watershed. This index is represented on a continuous scale from 0 to 5, where 0 represents areas with the lowest risk of flooding and 5 represents areas with the highest risk of flooding. This risk index layer will then be used to prioritize areas for further investigation using a combination of GIS, SWMM modeling, community outreach, and ground-truthing, as necessary.

Scope of Services

Task 1 of 4: Develop the Flood Risk Index

Brief description of activities involved: The Flood Risk Index is basically a numerical ranking of flood risk from 0 (lowest risk) to 5 (highest risk). Flood Risk is determined by considering hazard (impacts that may cause loss of life, damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources), economic vulnerability (the presence of people, ecosystems, infrastructure or economic, social or cultural assets in places that could be flooded) and social vulnerability (the propensity to being adversely affected including susceptibility to harm and lack of capacity to cope and adapt). As a result, the Flood Risk Index is developed by intersecting the Flood Hazard Layer (where flooding is likely to happen), with the Social Vulnerability Layer which reflects local demographics and the Economic Vulnerability Assessment which evaluates the impact/value of losses. Once the Flood Risk Index is established, the CLFLWD and member communities can see where flood risk is the highest by looking at a map of the watershed or by looking at those areas with the highest Flood Risk Indices.

Step 1a. Flood Hazard Layer

In the summer of 2022, the CLFLWD developed a Flood Hazard Layer (FHL) for the watershed. The FHL was developed by chaining together a combination of pre-built terrain analysis tools and watershed-specific calculations in a GIS application based on research by Rincón et al. The FHL is a relative metric, which means that it can help identify which locations in the watershed are likely subject to a high degree of flood hazard (i.e., are flooded more frequently) than other areas, but it does not provide an absolute indication of the frequency of that flooding (i.e., whether those locations are flooded once every 1, 10 or 100 years). The FHL is used to identify sources of both pluvial (flooding independent of an overflowing waterbody) and fluvial (when rivers or streams exceed their capacity) flooding that do not directly result from capacity limitations inherent in existing stormwater infrastructure and, as such, has limited usefulness in directly analyzing and optimizing stormwater conveyance systems. However, because the FHL is derived from high resolution topographic data (i.e., LiDAR), the analysis produces fine-scale outputs that do not require the same level of data collection and other prior knowledge that is required when constructing a hydrologic and hydraulic model. The FHL can thus be used to strategically inform where additional data collection and model refinement is needed.

The FHL was developed in 2022 with the expressed purpose of using it for the Greenway Corridor Evaluation. Due to the short timeline involved, the FHL was developed quickly and was only quality controlled in areas applicable to the Greenway Corridor. For this reason, the FHL needs to be reviewed more thoroughly across the rest of the watershed and regenerated as necessary – including to accommodate landlocked basins (discussed below).

Step 1b. EOR will develop an approach for assigning a flood hazard index to landlocked portions of the system.

While the FHL was developed in 2022 for the Green Corridor Evaluation, it was not fully completed. Given the application of the Flood Risk Assessment to the entire watershed, it will be important to evaluate the impacts that landlocked basins will have on flood risk. Since landlocked basins will accumulate water more quickly than other (flatter) parts of the drainage system, it will be important to develop a unique flood hazard index for landlocked basins that will allow for comparison across the watershed.

Step 1c. Social Vulnerability Layer

The Social Vulnerability Layer (SVL) accounts for the following information: Population Density, Renters, Population below the Poverty Line, non-English speakers, Population without a High School Diploma, Children under 4 years of age, People over 75 years of age and single parents. While this layer was created in the Spring of 2022, the 2020 census data has been made available. This project includes updating the SVL to reflect the 2020 census information.

Step 1d. Economic Vulnerability Layer

EOR did not conduct an Economic Vulnerability Assessment in the Spring of 2022. In order to complete the Flood Risk Index, this work will need to be completed. The Economic Vulnerability Assessment includes an assessment of the value of losses by intersecting flooding with the land use/zoning layers.

Step 1e. Flood Risk Index

This step involves intersecting the Flood Hazard Layer (Steps 1a and 1b) with the Social Vulnerability Layer (Step 1c) and the Economic Vulnerability Layer (Step 1d) to generate a singular numerical indicator of where flooding is most impactful in the watershed, represented on a scale of 0 to 5, where 0 represent the lowest risk and 5 represents the highest.

Completion of this task will involve:

- Revisiting and refining the Flood Hazard Layer.
- Determining how to evaluate and assign a hazard index to landlocked portions of the system.
- Reconstructing the Social Vulnerability Index using the new (2020) census data.
- Performing the Economic Vulnerability Assessment.
- Completing the Flood Risk Index and the Flood Risk Map.
- Meeting to review the FHL, Social Vulnerability Layer and the Flood Risk Index to preliminarily identify areas sensitive to flooding w/ Watershed District staff (including those of the Rice Creek Watershed District and other neighboring WMOs), member communities, others.
- Selection of three (3) areas to complete the Flood Risk Assessment (for further evaluation in Task 2).

Timeframe: September 2023 – November 2023

Name and Title of person(s) responsible:

- Camilla Correll, PE, Water Resources Engineer, EOR
- Cecilio Olivier, PE, COO, EOR
- Mike Talbot, Water Resources Engineer, EOR
- Bill Yu, Civil/Water Resources Engineer, EOR

- Sarah Voje, GIS Manager, EOR
- Emily Heinz, Planning Coordinator, CLFLWD

Task 2 of 4: Conduct Flood Risk Assessment

Brief description of activities involved: The increase in flood events in recent years highlights the need to complete flood risk assessments as an important component of flood mitigation. By using the flood risk maps developed under Task 1, the District can work with its member communities to better assess flood vulnerability in the watershed. This task will use the FHL, the Social Vulnerability Layer and the District’s H/H models to evaluate impacts to critical infrastructure, environmental features and social systems to identify specifically how these features are vulnerable to flooding (e.g., at what frequency, to what degree) in order to identify specific mitigation opportunities.

Specifically, this task will include the following steps:

Step 2a. Drainage Infrastructure Assessment

The three priority areas identified in Task 1, will be evaluated using the District’s H/H models. This evaluation will consider how well the drainage system performs under historic (Atlas 14) precipitation patterns as well as projected precipitation patterns. Using drainage systems design standards, EOR will evaluate which components of the local drainage system are under-capacity and contributing to flooding of the system. Information collected during this Step of the project will be shared with the CLFLWD staff and member communities to anecdotally validate the findings.

Step 2b. Social Risk Assessment

This step involves evaluating the intersections of flood hazard and socio-economic vulnerability with other local datasets to further evaluate specific features (e.g., buildings, roads) located in areas found in Task 1 to be at high risk. All three risk assessments (Steps 2b through 2d) will be performed with District staff and member communities to ensure that all economic and social vulnerabilities are being captured through the exercise. Spatial datasets to be considered for this step include:

- Social Equity layer (e.g., Center for Disease Control and Prevention’s Social Vulnerability Index)
- Buildings subject to flooding
- Road safety
- Historical/cultural features
- Contaminated sites
- Productive (agricultural) lands

Step 2c. Environmental Risk Assessment

This step involves evaluating the intersections of flood hazard and socio-economic vulnerability with other local datasets to identify areas at risk of flooding. All three risk assessments (Steps 2b through 2d) will be performed with District staff and member communities to ensure that all economic and social vulnerabilities are being captured through the exercise. Spatial datasets to be considered for this step include:

- Parks/Open Space/Natural Assets
- Groundwater recharge areas

Step 2d. Critical Infrastructure Assessment

This step involves evaluating the intersections of flood hazard and socio-economic vulnerability with other local datasets to identify areas at risk of flooding. All three risk assessments (Steps 2b through 2d) will be performed with District staff

and member communities to ensure that all economic and social vulnerabilities are being captured through the exercise. Spatial datasets to be considered for this step include:

- Elevations of critical infrastructure (e.g., fire stations, pumping stations, schools, hospitals, etc.)
- Emergency Services/Emergency Routes
- Road networks
- Utilities

Step 2e. Scenario Planning

Once all of the economic and social vulnerabilities have been identified for the three (3) priority areas, EOR will identify how much rate and volume control is needed to mitigate the flooding under historic and projected conditions. EOR will also complete scenario planning to determine the amount of stormwater management needed to address the flooding including:

- Underground Storage
- Volume Control
- Green Infrastructure
- Wetland/Habitat Restoration
- Infrastructure Upgrades

Step 2f. Review Recommendations with District Staff and Member Communities.

Development of the flood risk assessment will involve a series of meetings with District Staff and representatives of its member communities to ensure that that all vulnerabilities are being captured through the exercise. EOR will develop the agenda with District Staff. It is assumed that District Staff will coordinate meeting invitations and meeting logistics. The following series of meetings have been included in this scope of services:

- Meeting to review the findings of the drainage infrastructure assessment and review available and/or priority datasets for the risk assessments (Step 2a).
- Meeting to review and discuss all three risk assessments (Steps 2b through 2d).
- Meeting to review the results of the scenario planning exercise (Step 2f).

Completion of this task will involve:

- Meeting to review available and/or priority datasets w/ District Administrators, member communities, others.
- Series of maps highlighting the intersection of the FHL with Social (Step 2b), Environmental (Step 2c) and Critical Infrastructure (Step 2d) data layers.
- Results of the scenario planning (Step 2e) exercise.
- Meeting agendas and summaries.

Timeframe: November 2023 – December 2023 (depending upon people's availability)

Name and Title of person(s) responsible:

- Camilla Correll, PE, Water Resources Engineer, EOR
- Cecilio Olivier, PE, COO, EOR
- Mike Talbot, Water Resources Engineer, EOR
- Paul Nation, Water Resources Engineer, EOR
- Bill Yu, Civil/Water Resources Engineer, EOR
- Sarah Voje, GIS Manager, EOR
- Sonya Carel, Visual Communications Director, EOR

- Emily Heinz, Planning Coordinator, CLFLWD

Task 3 of 4: Community Resilience Building Workshops

Brief description of activities involved: Following the development of the Flood Hazard Layer and the Flood Risk Assessment, District Staff will consider how best to share this information with the CLFLWD Board Managers and member communities for additional refinement. Originally, it was envisioned that this engagement would take the form of the Community Resilience Building (CRB) process developed by The Nature Conservancy which is the structure taken by the Rice Creek Watershed District. These workshops would engage member communities, Washington County, Chisago County, state agency representatives, and local non-profits that represent at-risk populations. The following description articulates how this series of Community Resilience Building Workshops would be conducted. However, it is recommended that the CLFLWD revisit what kind of engagement is needed after conducting Tasks 1 and 2 of the Flood Risk Assessment.

- Where is there potential flood hazard that attendees are not previously aware of?
- Where is there flood risk that needs better definition?
 - Are there (other) vulnerable communities that need to be accounted for in this assessment?
- What actions can be taken to reduce vulnerabilities in areas identified as being at risk for flooding?
- Where are the priorities for additional planning and action?

Completion of this task will involve:

- In the first (4-hour) workshop, review the Flood Hazard Layer with workshop participants. Identify climate hazards that occurred in the past, the intensity and frequency of these hazards, and document their associated impacts.
- Use the information generated under Task 2 Flood Risk Assessment to identify vulnerable populations, infrastructure and environmental features. This initial vulnerability assessment will consider the adaptive capacity of these assets and population groups to flooding due to climate change.
- This information will be used to populate a risk scoring matrix (see Figure 2 for an example) which can be used to prioritize additional planning and actions to be facilitated or undertaken by the watershed district and its member communities.
- Hold a second (4-hour) workshop to discuss potential future actions, roles and responsibilities. Participants will build off the outcomes in the first workshop to determine what actions might be taken to diminish hazard risk in vulnerable areas. They will also work together to determine who needs to be involved in carrying out the actions suggested, and what other resources may be necessary.

		Probability			
		Do Not Know	Low	Moderate	High
Consequence	High	R1	R3	R4	R5
	Moderate	R1	R3	R4	R4
	Low	R1	R2	R3	R3
	Do Not Know	R1	R1	R1	R1

Figure 2. Example risk scoring matrix

Timeframe: TBD

Name and Title of person(s) responsible:

- Beth Carreño, Senior Program Manager CLFLWD
- Emily Heinz, Planning Coordinator, CLFLWD
- Camilla Correll, PE, Water Resource Engineer, EOR

Task 4 of 4: Final Report and Project Deliverables

Brief description of activities involved: EOR will summarize the steps taken to conduct the Flood Risk Assessment in a technical memorandum to the CLFLWD Board of Managers. It is assumed that District Staff will use the results of this assessment to explore and define the roles and responsibilities of the CLFLWD in flood management moving forward.

Timeframe: TBD

Completion of this task will involve:

- Technical report detailing the development and use of the FHL, Social Vulnerability Layer and the Flood Risk Index.
- Community Resilience Building Workshop Summary.
- Conclusions and recommendations for future model refinement needs and for the establishment of a flood management program.

Name and Title of Person(s) Responsible:

- Emily Heinz, Planning Coordinator CLFLWD
- Cecilio Olivier, PE, COO, EOR
- Camilla Correll, Water Resource Engineer EOR
- Sonya Carel, Visual Communications Director, EOR

Task	Estimated Hours	Estimated Cost
Task 1: Develop the Flood Risk Index	77	\$11,819
Task 2: Conduct Flood Risk Assessment	114	\$16,676
Task 3: Community Resilience Building Workshops	<i>TBD</i>	<i>TBD</i>
Task 4: Final Report and Project Deliverables	<i>TBD</i>	<i>TBD</i>
Totals	191	\$28,495