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Cultivating Community Resilience and Adaptation through Flood Risk Assessments

PRESENTED BY

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CULTIVATING COMMUNITY RESILIENCE AND ADAPTATION

A wide-angle photograph of a park. In the foreground, a calm pond reflects the sky. The middle ground shows a grassy area with a paved path, a gazebo, and a small concrete structure with a pipe. The background is filled with lush green trees and several houses. The text 'FLOOD RISK ASSESSMENT' is overlaid in large white letters across the center of the image.

FLOOD RISK ASSESSMENT



Rochester - downtown stormwater feature

CONSULTING TEAM/PARTNERS

Emmons & Olivier Resources, Inc.

- Project Management and Water Resources

Perkins & Will

- Urban Planning, Resiliency and Sustainability, Public Relations, and Social Equity

Freshwater

- Community Engagement and Public Relations, Social Equity, Groundwater Advisor

City of Rochester

- Public Works, Environmental Services, Eng. & Maintenance
- Parks and Recreation, Parks and Forestry
- Community Development
- Rochester Public Utilities



Rochester Cascade Park – *floating plantings*

ADDRESSING CLIMATE CHANGE

How do cities and communities plan and prepare for impacts from climate change?

- Evaluating projected climate impacts
- Engage the community and promote awareness of climate vulnerabilities
- Prioritize the needs and develop community-based solutions and adaptation strategies

Sustainability and Resiliency Community Work Plan

Created by and for
Our Community Members



COMMUNITY RESILIENCE HUB

Foundation for the Project

- An overarching objective of the CSWMP is to collaborate with other departments for joint benefit, i.e., identify where synergies exist
- With sustainability and resiliency being central to the CSWMP, there was a natural alignment with the City's [Sustainability and Resiliency Community Work Plan](#)
- Focus Areas of the plan include:
 - *Climate Change Resiliency*
 - *City for Health*
 - *Vibrant Neighborhoods*
 - *Accessible Transportation*
 - *Resilient Economy*
 - *Environmental Health*

Focus Area: City for Health

Strategy H2

Resiliency Hubs: Create a network of resource hubs to increase residents' access and education to respond to community needs

**City Council Priority**
Housing and Affordable Living,
Quality Living & Quality Services

**Planning2Succeed:
2040**


**UN Sustainable
Development Goal**


Tactic a.: Create a hub with access to social services such as housing, accessible food, legal help, etc. These services will be provided via a website and in a physical space in accessible locations.

Justification: Provide complimentary, easily accessible and holistic social service programming and free resources for community members in poverty. Connect to existing programs such as the Senior Advocacy Program and Senior Linkages Line.

Tactic b.: Create a community health hub where services are provided via a website and through pop-ups or at existing health care locations. Prioritize mental health services participation and vaccination information.

Justification: Provide mental and physical health resources while ensuring access to services addressing language, distance, disability, and gender barriers. Create educational promotions to curb disinformation; create space for cross-cultural conversations and community-driven vaccination events. Partners: public health OC, Rochester Community initiative, Rochester Healthy Community Partnership.

Tactic c.: Create an emergency shelter hub where services and resources are provided via the web and existing building spaces. Create new and improve existing safe places to shelter during times of disaster for residents.

Justification: Help communities facing immediate climate threats, such as, flooding, extreme heat and cold, storms, etc., as well as immediate needs of loss of housing, physical danger, and food or water needs. Support and enhance existing strategies outlined in the Emergency Management Plan (Section 8) related to safe places to shelter and community engagement. Education and outreach tactics exist but not at the necessary—build off the EMP and identify opportunities to engage with the community directly, in person, within neighborhoods.

- Assess 211 Data to find gaps in resources and improve connectivity to those resources.
- Work toward goal of not relying on utilities to maintain temperature and comfort.
- Implementation of city-wide access to technology and development of community plan to provide free high quality internet, apps, etc., that would likely require partnerships across sectors.
- Prepare the community for emergency situations; ensure homes have adequate resources through community resources and supply drives.
- Support and enhance education and awareness initiatives as outlined in the Emergency Management Plan (EMP); evaluate opportunity for community liaison to educate and engage with diverse communities.

COMMUNITY RESILIENCE HUB

Foundation for the Project

- A specific strategy was identified that leveraged work already being performed for the CSWMP: 'Resiliency Hubs: Create a network of resource hubs to increase residents' access and education to respond to community needs'
- A MPCA Planning Grant for Stormwater, Wastewater, and Community Resilience was applied for: Resilience Hub Planning using Flood Risk Assessment in the City of Rochester
- The MPCA grant helped fund the hydrologic and hydraulic modeling (Risk Assessment) of a priority subwatershed of the South Fork of the Zumbro River, Cascade Creek, and community engagement via the Co-Design Process



RISK BASED MANAGEMENT

What is a flood risk assessment?

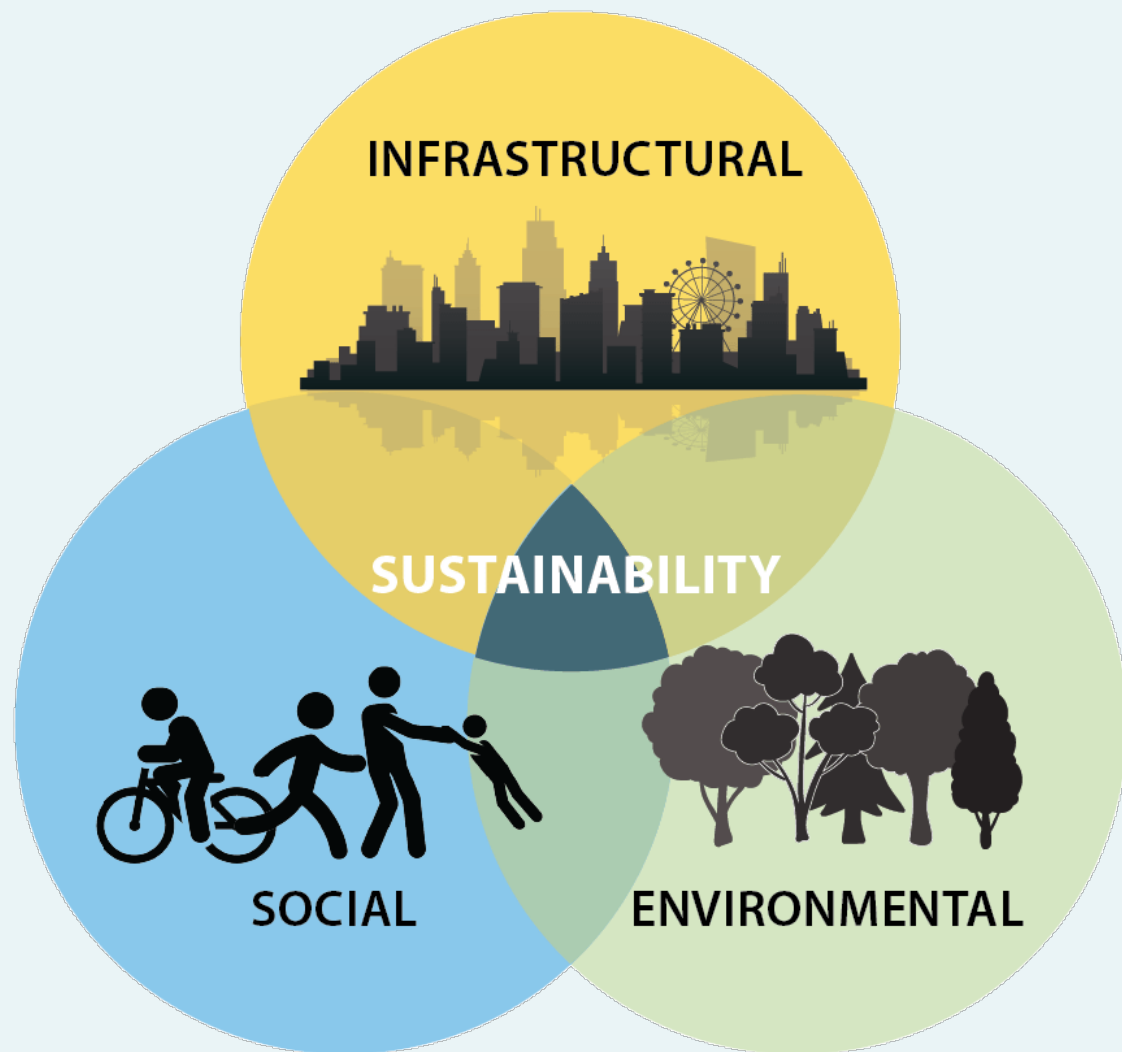
- Assessment that identifies the flood risks that can affect a community based on hydrologic and hydraulic model evaluations, estimates the potential frequency of inundation, and assesses the impacts or consequences to life and property.
- Flood risk assessment conducted for CSWMP unique in that it took a more comprehensive approach to evaluating vulnerabilities.



RISK BASED MANAGEMENT

Evolving, multi-dimensional approach

- Historically Flood Risk Assessments a one-dimensional evaluation of risk:
 - *Flooding (riverine) = 100-yr, 24-hr event*
 - *Stationarity*
 - *Consequences are monetized*
- Climate change has added another dimension to the evaluation
 - *More precip., more frequent + larger storms*
 - *Non-Stationarity*
 - *Impacts related to other types of flooding*
- Social and environmental factors add a third layer



FLOOD RISK ASSESSMENT

Process taken for the CSWMP

- Identify what can be evaluated within each component of sustainability
- Develop likelihood/consequence plots for each component of sustainability
- Evaluate risk per component of sustainability and combined
- Prioritize subcatchments considering the risk dimension of each component of sustainability



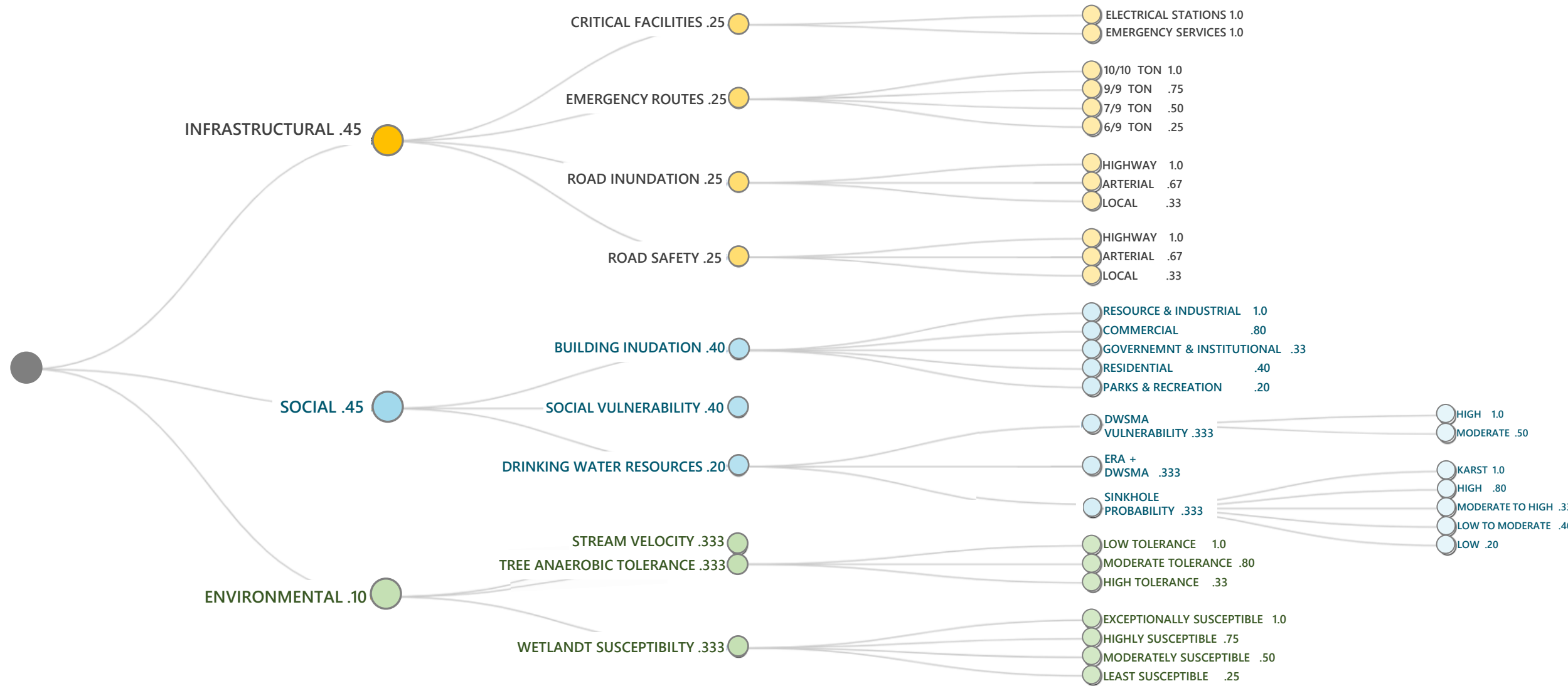
FLOOD RISK ASSESSMENT

What can be evaluated within each component of sustainability?

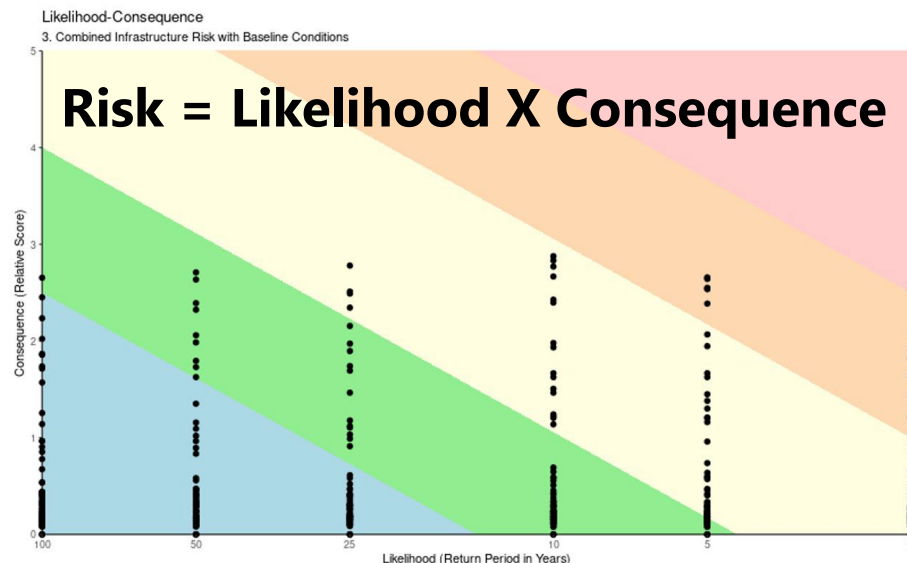
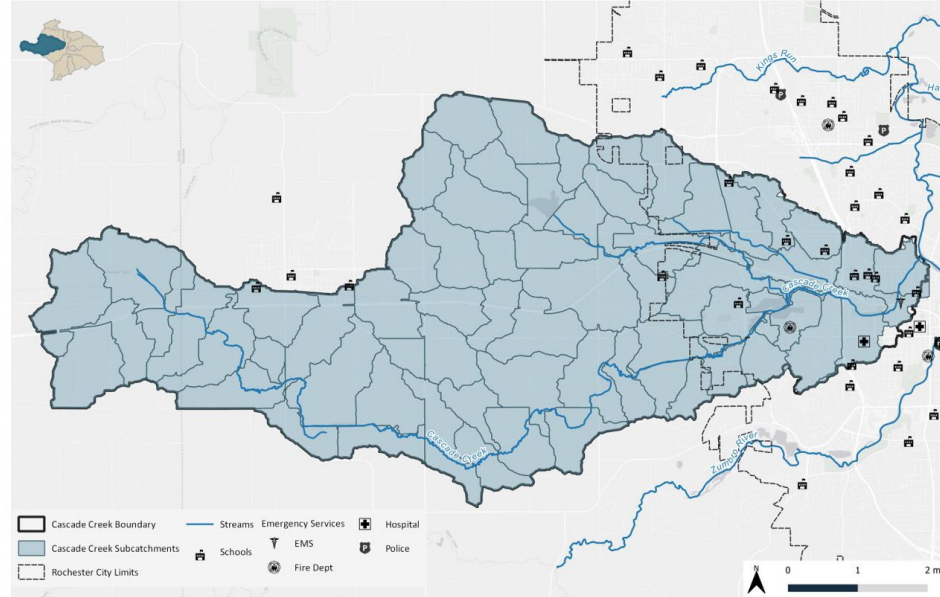
- **Infrastructural – 45%**
 - a. Critical Facilities – *Emergency Services & Electrical Stations*
 - b. Roadway Inundation – *Length of flooded road*
 - c. Road Safety - *Depth-Velocity Classification*
 - d. Emergency Routes
- **Social – 45%**
 - a. Building Inundation
 - b. Drinking Water Resources
 - c. Social Vulnerability
- **Environmental – 10%**
 - a. Wetland Sensitivity
 - b. Tree Anaerobic Tolerance
 - c. Streambank Stability

RESILIENCE & ADAPTATION: FLOOD RISK ASSESSMENT

DATA PROCESSING, TECHNICAL DETAILS



Cascade Creek Subwatersheds



FLOOD RISK ASSESSMENT

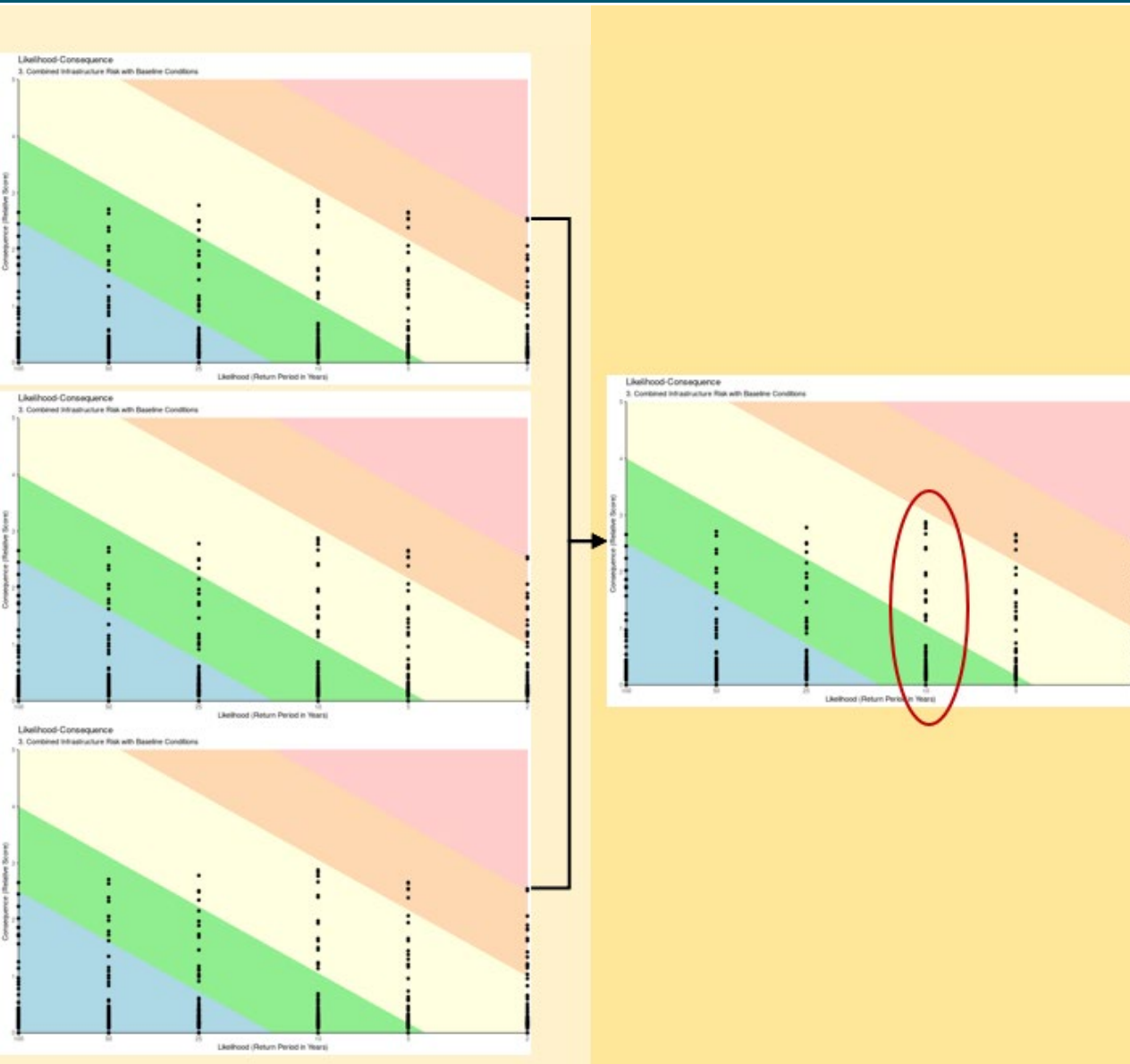
Developed likelihood/consequence plots

- What is a likelihood/consequence plot?
- Plots developed for all three scenarios (24 model runs)
 - a. Existing (baseline)
 - b. Existing + projected rainfall
 - c. Future (future land use + projected)
- Plots developed for each component/sub-component (10 sub-components)
- Total of 240 likelihood/consequence plots

FLOOD RISK ASSESSMENT

Evaluated risk per component of sustainability and combined

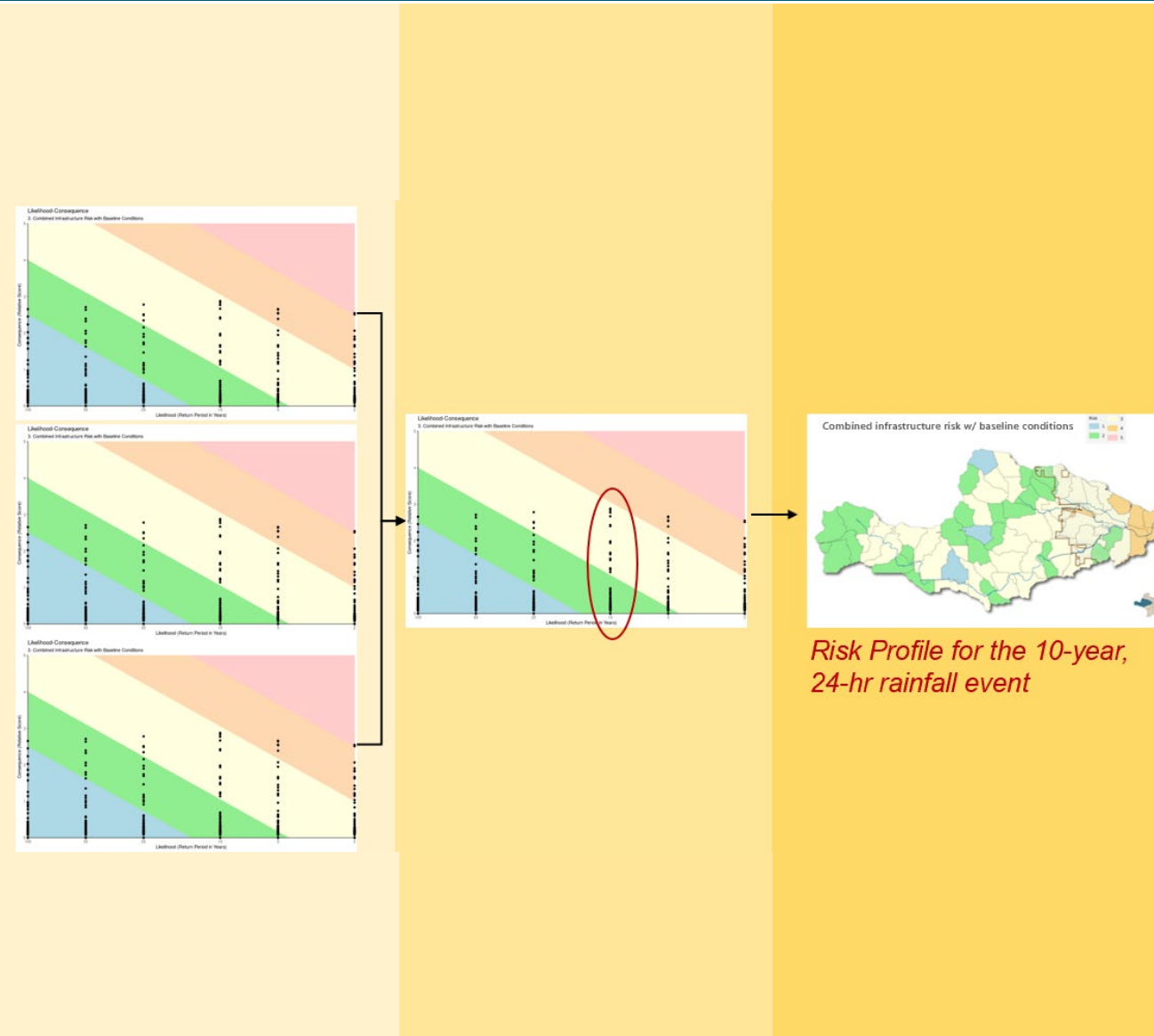
- Aggregated the information
- Aggregating requires the assignment of weights to the various sub-components



FLOOD RISK ASSESSMENT

Prioritizing subcatchments

- Prioritize subcatchments considering the risk dimension of each component of sustainability
- Creation of individual likelihood/consequence plots allowed the City to evaluate priority subcatchments by:
 - a. Each component of sustainability (infrastructural, social or environmental)
 - b. All three components combined



CULTIVATING COMMUNITY RESILIENCE AND ADAPTATION



What Are Resilience Hubs?



Resilience Hubs are community-serving facilities augmented to support residents, coordinate communication, distribute resources, and reduce carbon pollution while enhancing quality of life. Resilience Hubs can meet a myriad of physical and social goals by utilizing a trusted physical space such as a community center, recreation facility, or multi-family housing building as well as the surrounding infrastructure such as a vacant lot, community park, or local business.

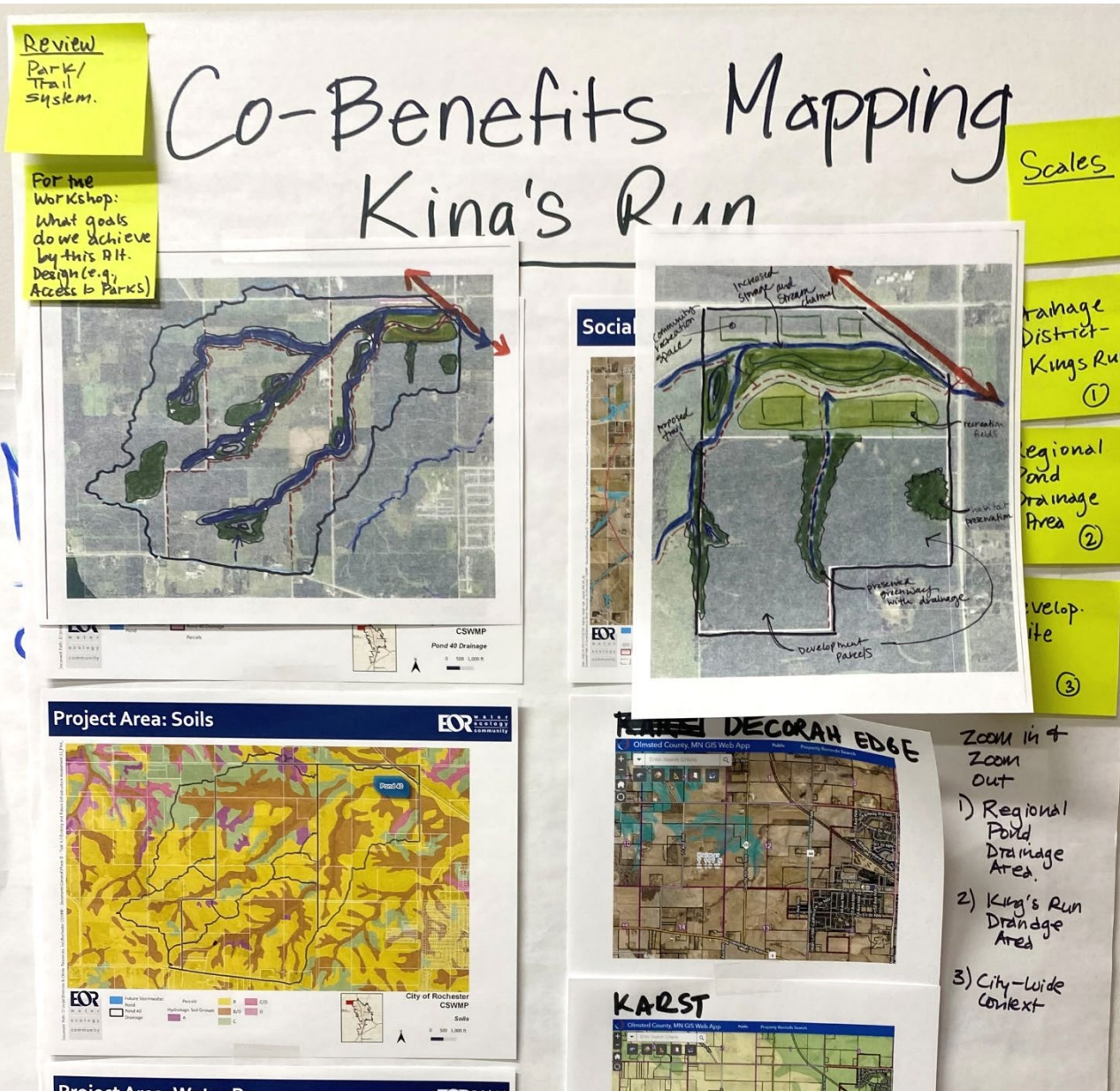
EQUITABLE COMMUNITY CO-DESIGN

"Co-Design is about challenging the imbalance of power held within groups of individuals who make important decisions about others' lives, livelihoods and bodies. Often, with little to no involvement of the people who will be most impacted by the decisions.

Co-design seeks to change that through building new relationships, capability and capacity for boundless curiosity. It uses inclusive convening to share knowledge and power. "

- "Beyond Sticky Notes." Kelly Ann McKercher

- Excerpt from *Community Co-design Tools + Tactics (Tool kit)*



EVALUATING LOCATIONS

- CSWMP Map Review
 - *Flood hazard layer*
 - *Critical services*
 - *Hazardous waste sites*
 - *Social vulnerability*
 - *Environmental Justice census tracts*
 - *Neighborhood associations*
 - *Institutions (schools)*
 - *Park types*
- City Park Review
 - *Location, City Ward, EJ Census Tract*
 - *Amenities*
 - *Trail connections*

RESILIENCE & ADAPTATION: FLOOD RISK ASSESSMENT

Satellite



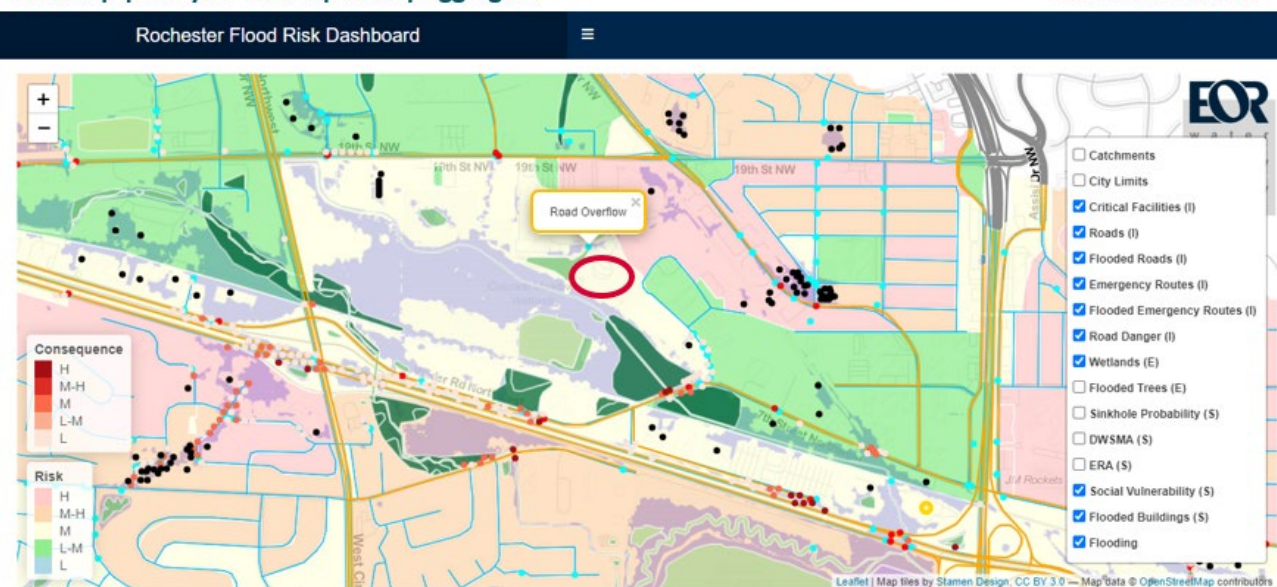
Cascade Meadow

IDENTIFYING POTENTIAL SITE

- EOR's Flood Risk Mapping Tool
 - Offers ability to check for issues associated with potential locations identified by co-designers
- Co-designer Identified Site Possibility:
CASCADE MEADOW
 - A non-government owned site, near existing community facility, unique energy security potential

Risk Map | 100 year return period | Aggregate

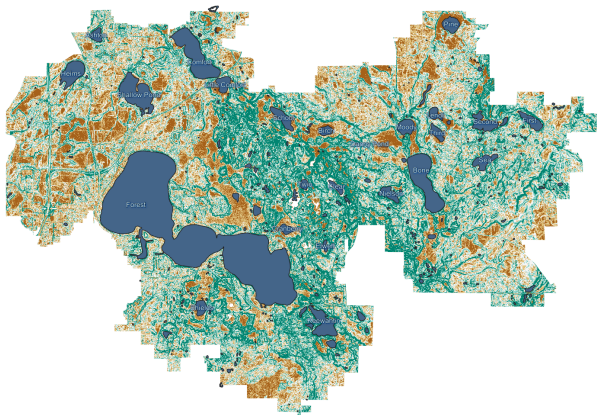
Cascade Meadow



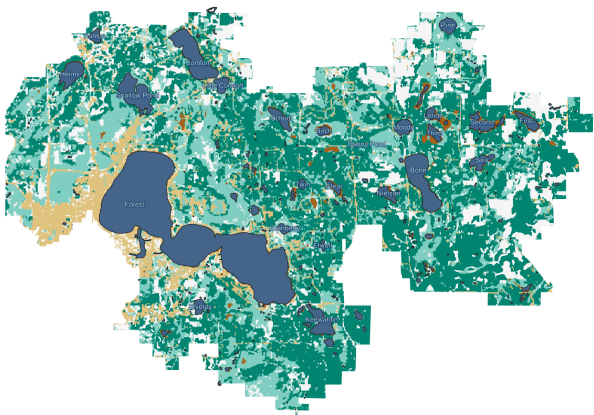


FLOODPLAIN VULNERABILITY ASSESSMENT

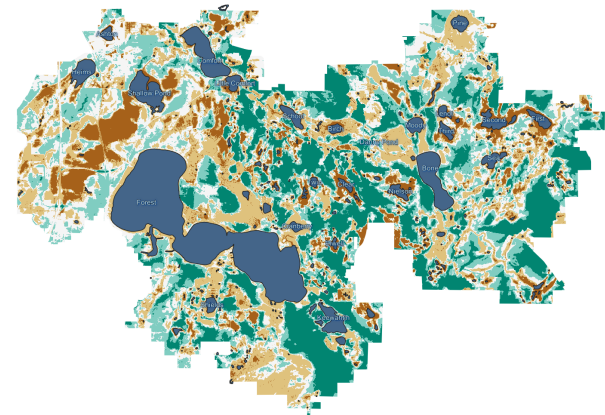
CLFLWD FLOODPLAIN VULNERABILITY



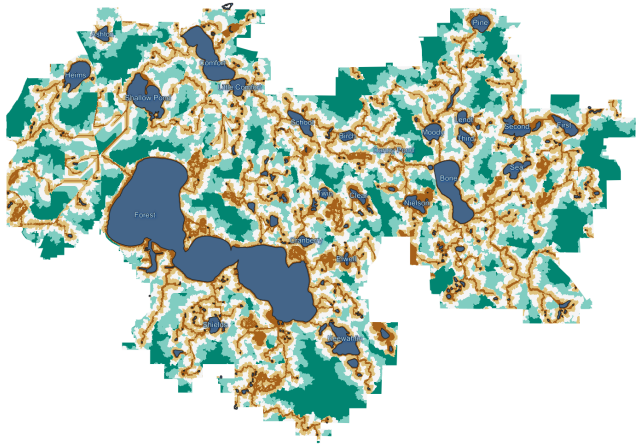
Slope



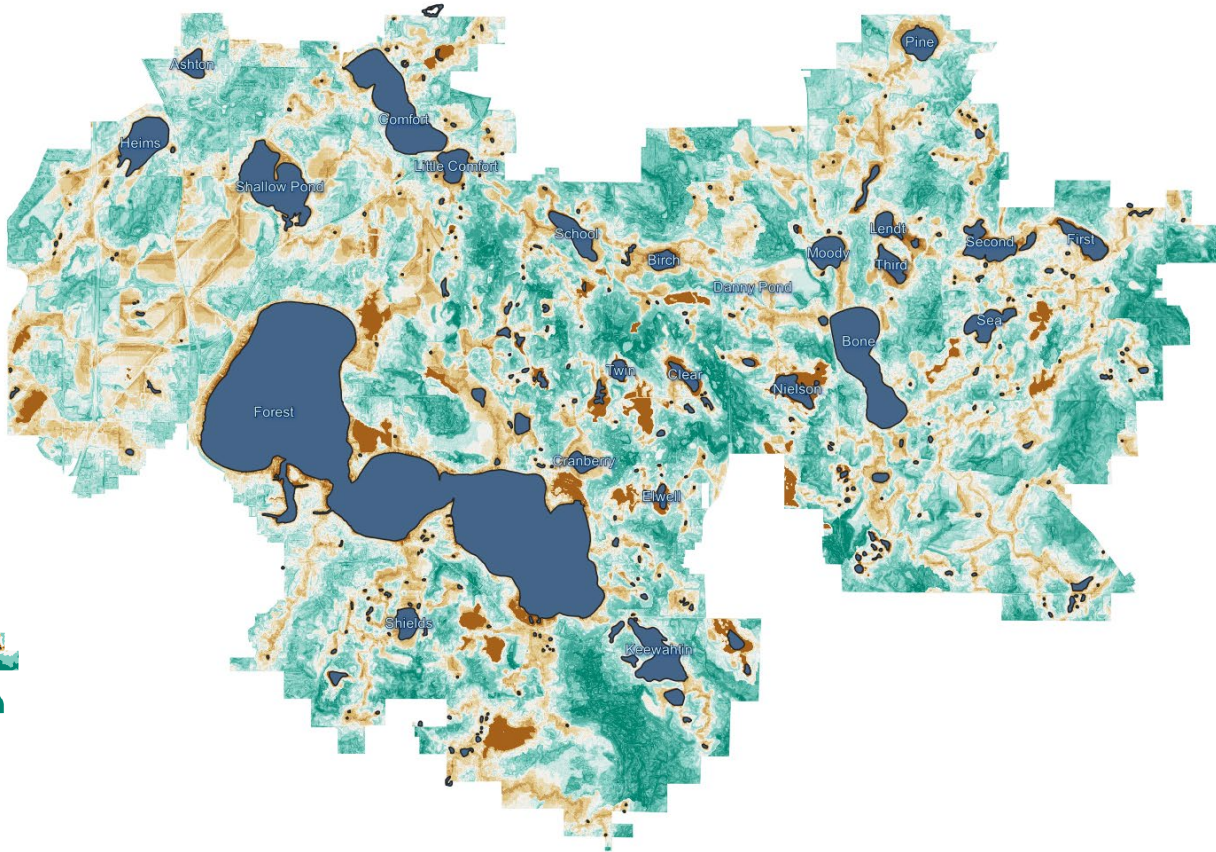
Curve Number



**Height Above Nearest
Drainage (HAND)**

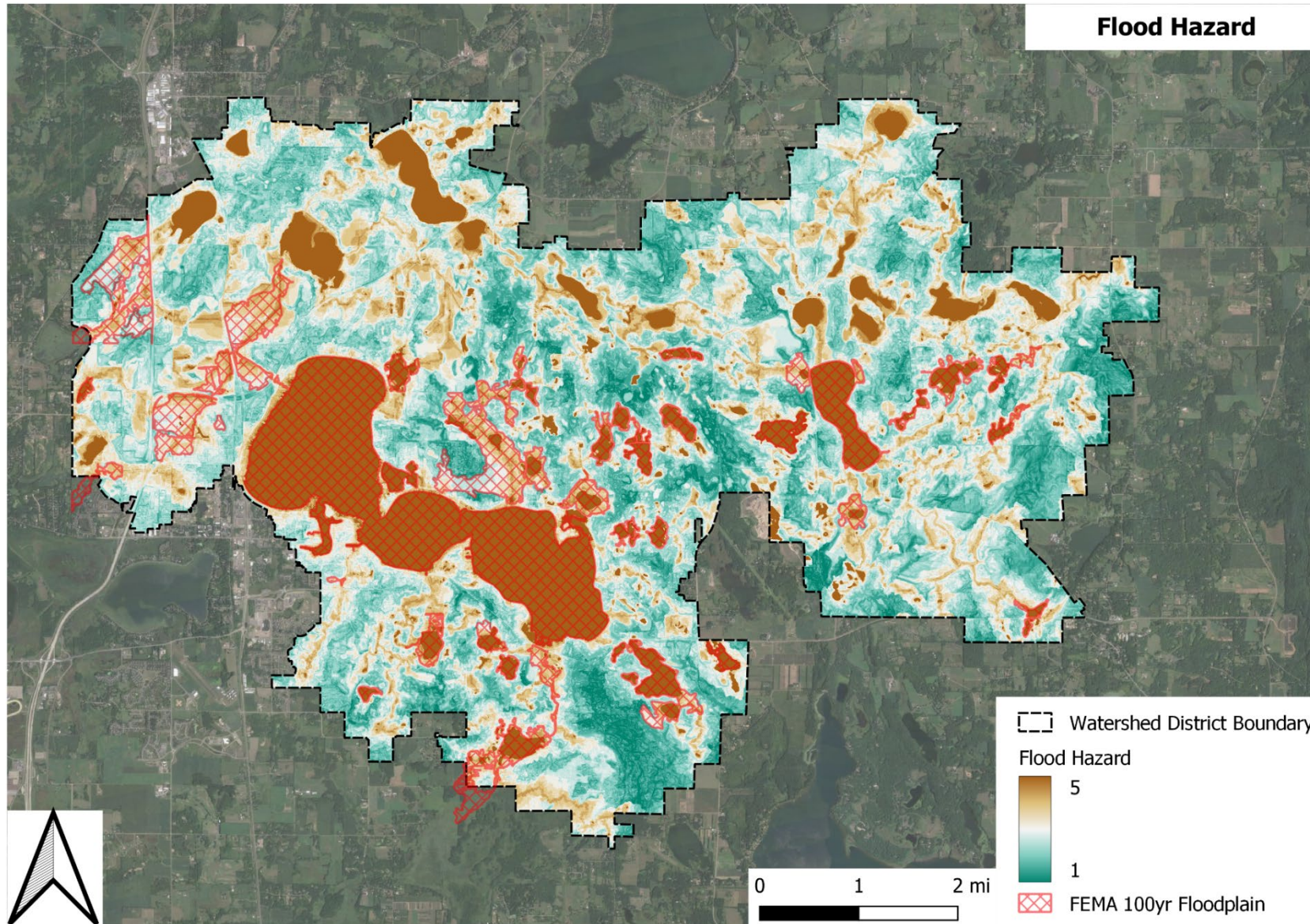


**Distance to Streams
(DS)**



Flood Hazard





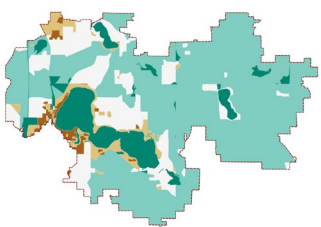
FLOOD HAZARD SCREENING

- **Flexibility**
- **Ease of handling**
- **Low cost**

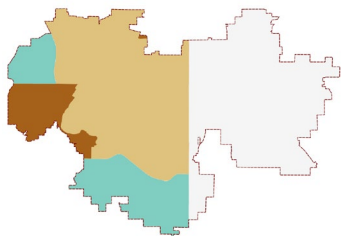
Rincón, D., Khan, U. T., & Armenakis, C. (2018). Flood risk mapping using GIS and multi-criteria analysis: A greater Toronto area case study. *Geosciences*, 8(8), 275.

CLFLWD FLOODPLAIN VULNERABILITY

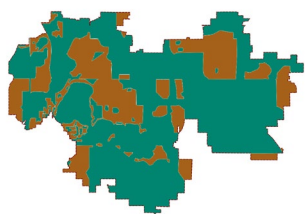
Population Density



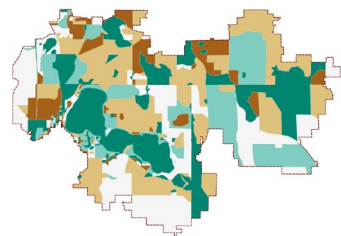
Population w/o a HS degree



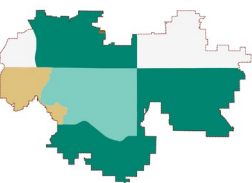
Renters



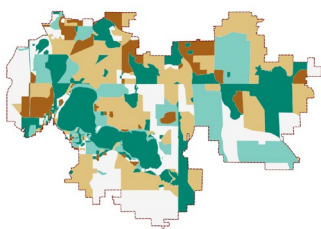
Children under 5 years of age



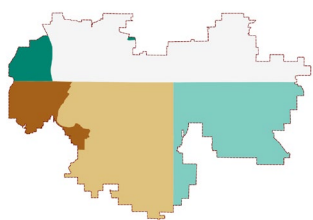
Population below the poverty line



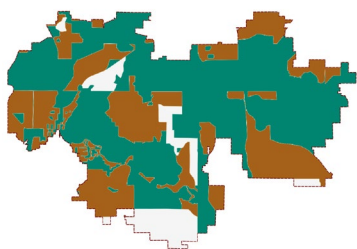
People over 75 years of age



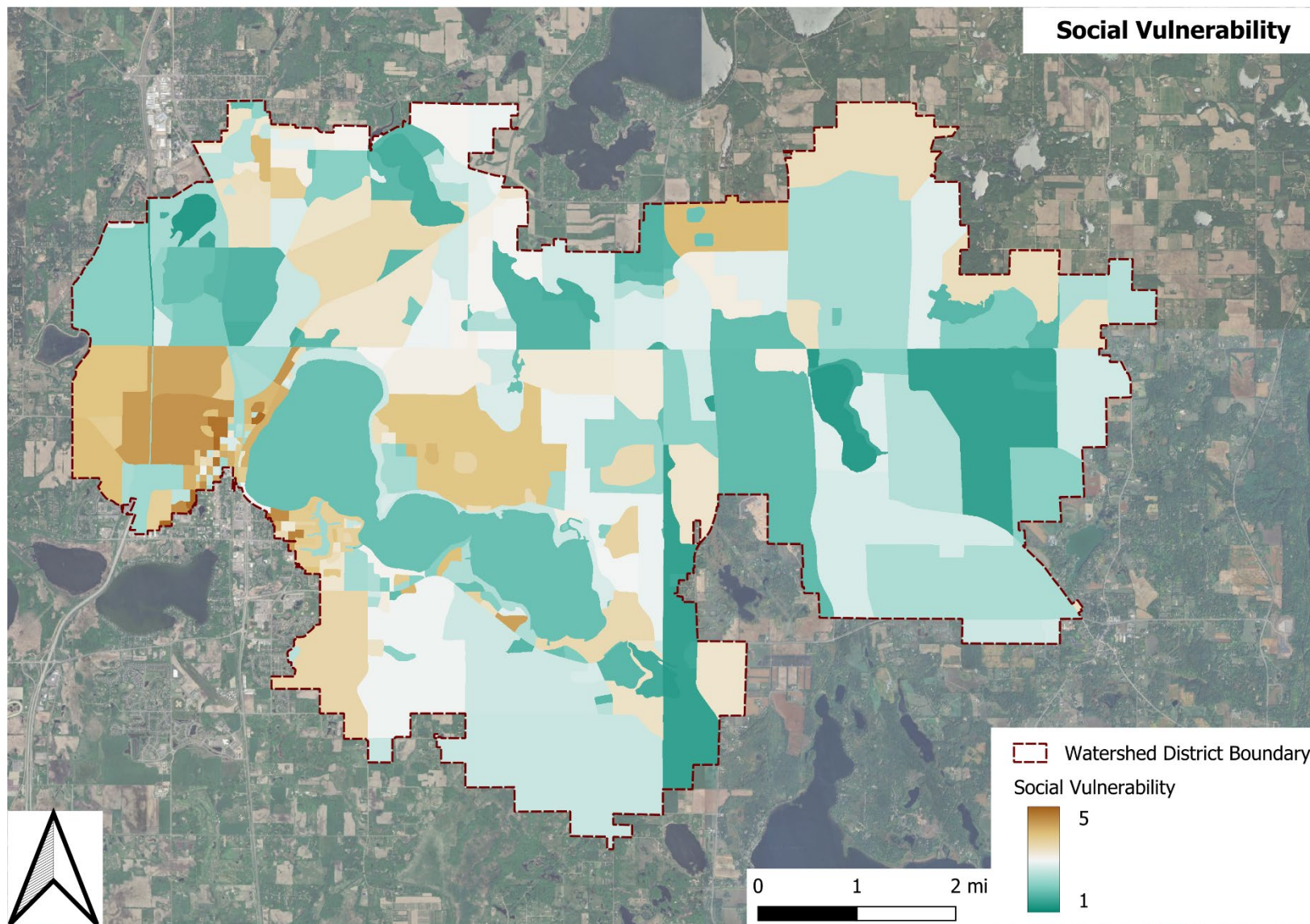
Non-English speakers



Single Parents



Social Vulnerability



ENVIRONMENTAL

Pollution Sensitivity of Near-Surface Materials

Impaired Waters

**Native Plant Communities
Connected with Groundwater**

Soil Erosion Risk

**Minnesota Biological Survey
(MBS) Sites of Biodiversity
Significance**

INFRASTRUCTURAL

Critical Infrastructure

Emergency Routes

Roadways

SOCIAL

Trails/Parks

Buildings

Social Vulnerability Layer

ENVIRONMENTAL

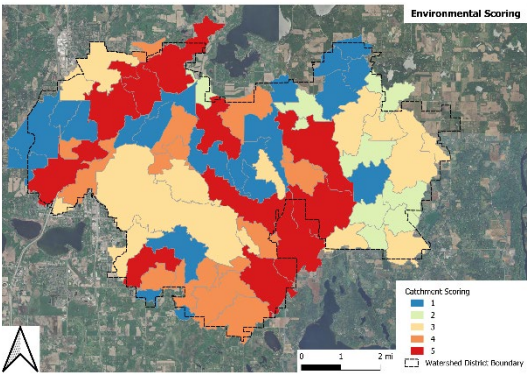
SOCIAL

INFRASTRUCTURAL

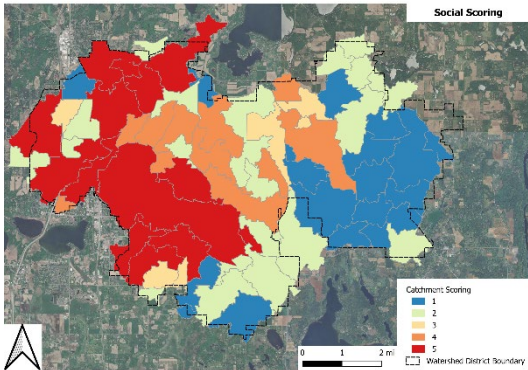
FLOOD HAZARD



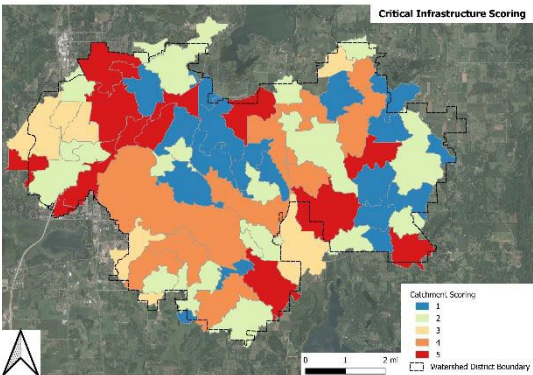
CLFLWD FLOODPLAIN VULNERABILITY



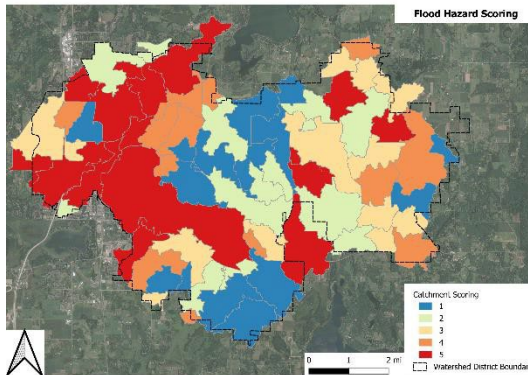
Environmental



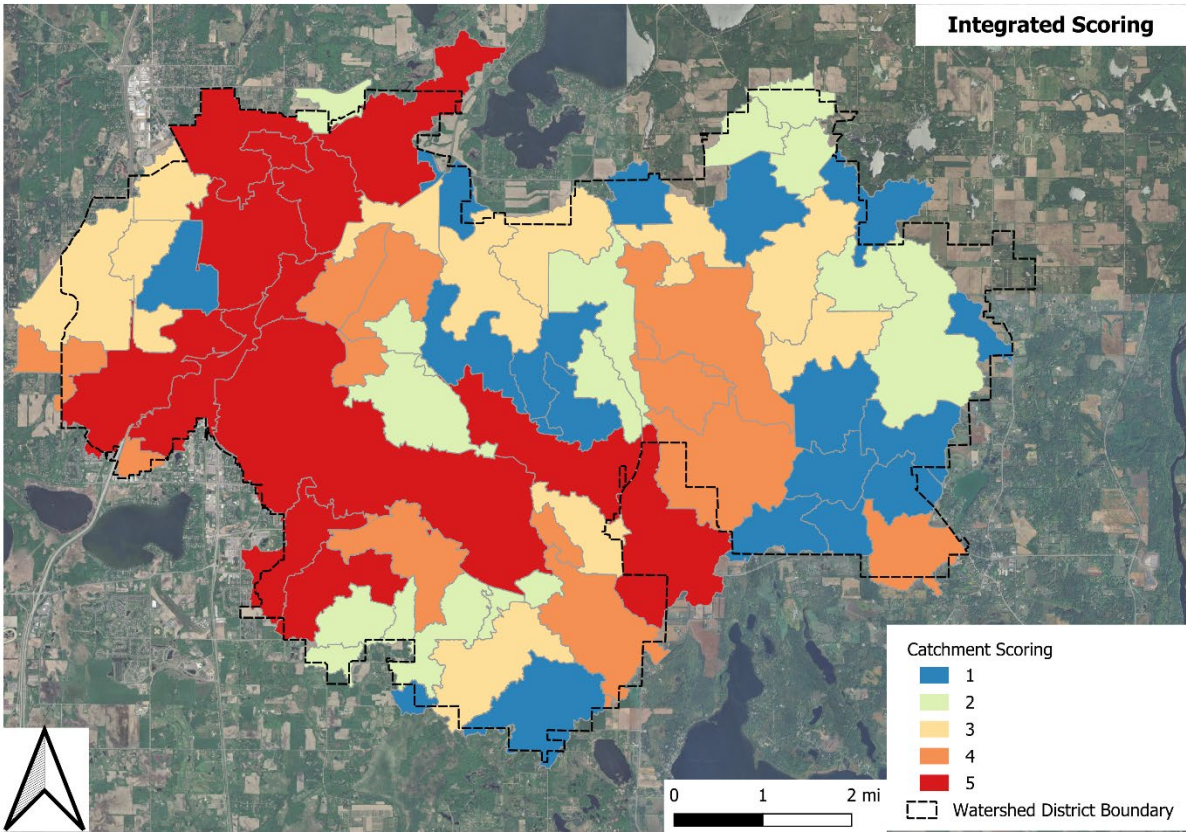
Social



Infrastructural



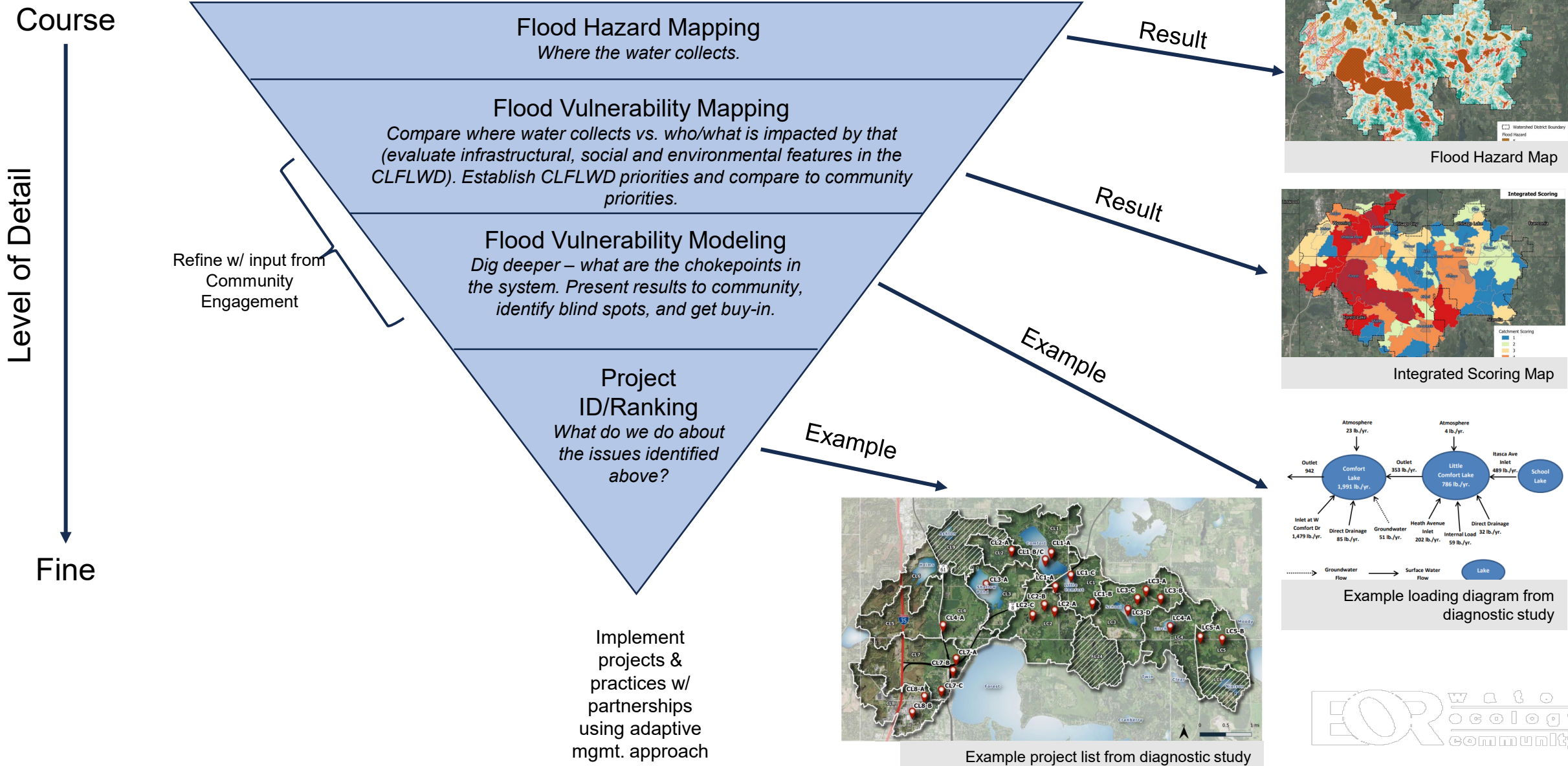
Flood Hazard



Integrated

Red = highest risk

CLFLWD FLOODPLAIN VULNERABILITY



Short term	Medium term	Long term
<ul style="list-style-type: none">• Property owner awareness campaign• Property owner resource guide• Maintenance guide for city staff (how to maintain ditches/ponds/etc.)• Cost-Share Programs (e.g., Shoreline/Ag BMPs) to improve landscape resiliency to flooding/severe rain events	<ul style="list-style-type: none">• Publicly-owned wetland restoration activities• Publicly-owned land stormwater management improvements (ex: park reuse or storage)• Review rules and policies w/ partners	<ul style="list-style-type: none">• Large-scale, multi-landowner regional stormwater treatment capital improvement projects• Greenway Corridor acquisitions, easements, enhancements, restorations

Questions?





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