Water Equity Mapping Tool

METROPOLITAN COUNCIL

Metropolitan Area Water Supply Technical Advisory Committee August 13, 2026 Lucia Zuvela

Project's purpose

Develop a tool that can inform the region to support water equity's policy desired outcomes

- All residents **have access to safe and affordable water for drinking, recreation, cultural, social, spiritual, or communal uses**.
- The public and ecosystem health benefits of **clean, safe surface and drinking waters** are fully achieved in all communities in the region.
- Water utility and ecosystem services gaps are prioritized and addressed in **overburdened communities**.
- **Historically marginalized and overburdened populations** are centered in water planning and management conversations and decisions.
- Improvements to the regional wastewater conveyance and treatment **systems enhance regional aesthetics and amenities as directed by communities.**

Overburdened Communities

Defined by the MPCA as:

"…areas or populations that face a disproportionate impact from environmental pollution or hazards due to various factors, such as socioeconomic status, race, ethnicity, or other demographic characteristics. These communities often experience a higher concentration of environmental risks, pollution sources, or adverse health effects compared to other areas, leading to increased vulnerability and disparities in exposure to environmental hazards."

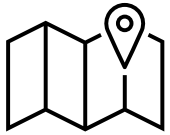
Research Question

How can we spatially identify priority areas for equitable water planning in the region?

1. Where are water-related challenges concentrated?
2. Where are communities experiencing greater vulnerability?
3. Where do these overlap and then highlight potential priority areas for intervention?

Approach

Composite Index



"a measure that combines multiple parameters or indicators to provide an overall assessment of the environmental health status of a particular area or population, often **summarizing underlying information via a single value or ranking" (Price et al., 2024)**

Used in many mapping tools assessing social vulnerability and environmental justice. Based and adapted from CDC SVI, EPA EJ Screen, CT EJ Screen and CCVA.

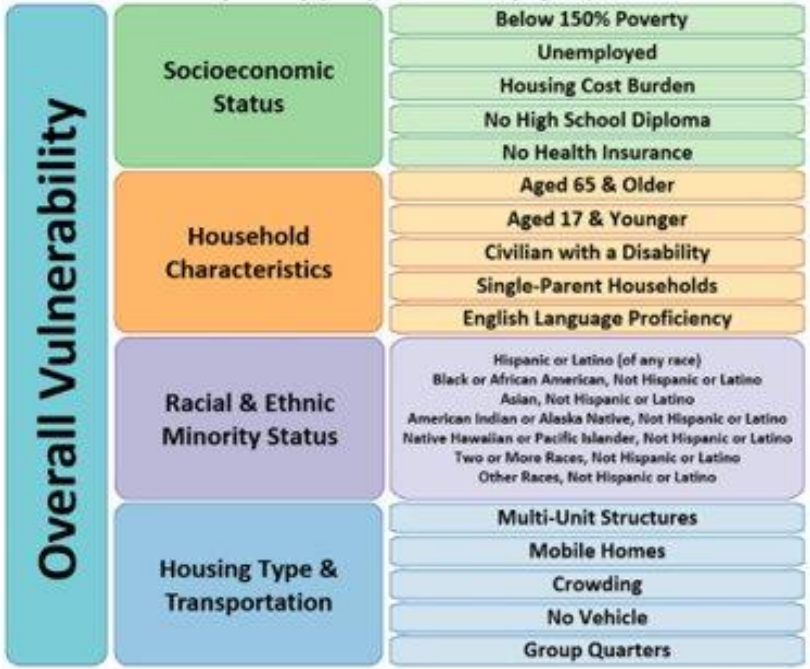
Examples

CDC SVI

Methods

Variables Used

American Community Survey (ACS), 2018-2022 (5-year) data for the following estimates:



CT EJ SCREEN TOOL

Overall Score	Environmental Justice Index Score = Pollution Burden x Sensitive Populations			
Composite Category	Pollution Burden $\frac{0.5\times average(PPS)+average(PPE)}{1.5}$		Sensitive Populations $\frac{average(SF)+average(HS)}{2}$	
Category	*Potential Pollution Sources (PPS)*	*Potential Pollution Exposure (PPE)*	*Socioeconomic Factors (SF)*	*Health Sensitivity (HS)*
Indicator	• Brownfield sites • Proximity to Superfund Sites • Impervious Surfaces • Incinerators • Landfills • Housing Lead Risk • Municipal Transfer Stations • Potentially Contaminated/Clean-Up Sites • Recycling Processing Facilities • Significant Environmental Hazards • Underground Storage Tanks • Facilities Managing Hazardous Chemicals • Wastewater Discharges	• Diesel PM Emissions • Noise • Ozone • Particulate Matter 2.5 • Facilities Releasing Toxics • Major Sources of Air Pollution • Minor Sources of Air Pollution • Minor Air Pollution Facilities • Traffic Density • EPA Cancer Risk Index • EPA Respiratory Hazard Risk Index	• Housing Burden • Linguistic Isolation • Poverty levels • Unemployment • Race/Ethnicity • Educational Attainment • Energy Burden • Median Income • Population Age < 5 • Population Age > 65 • No Health Insurance • Mobile Homes • Multi-unit Housing • Rent-ownership Ratio • Disability • Single Parent Households • Food Insecurity	• Asthma Emergency Dept. Visit Rate • Coronary Heart Disease • Emergency Dept. Visits for Chronic Lung Disease • Diabetes • Low Birthweight Rate of Infants • Declined Mental Health • Depression Rates

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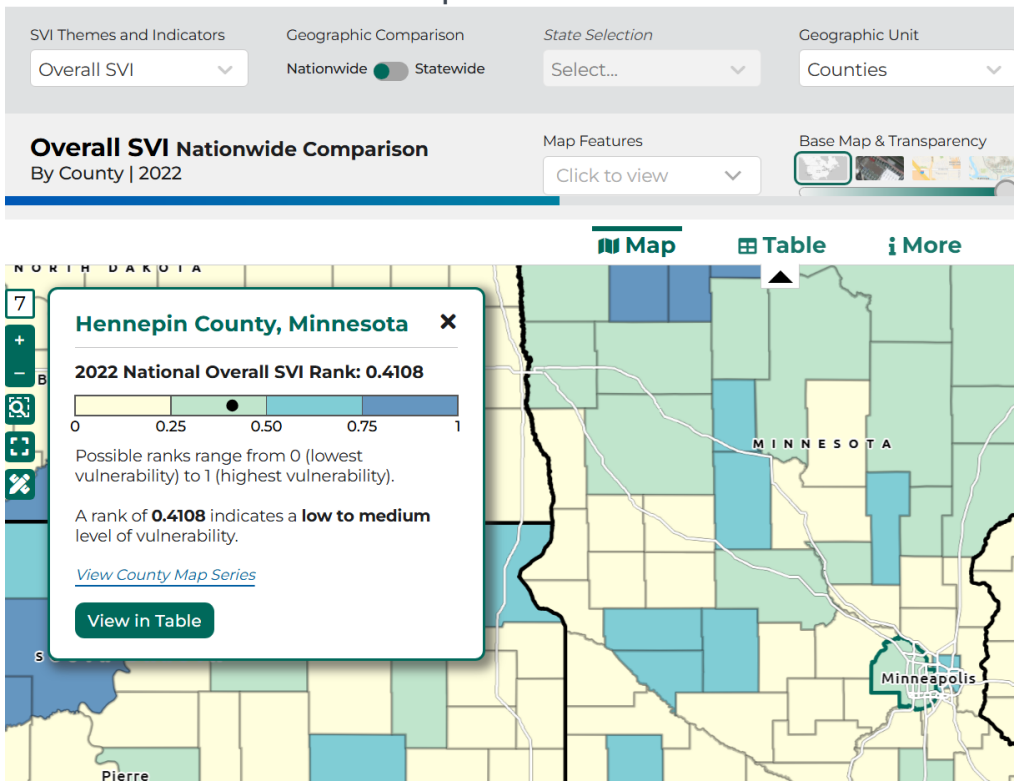
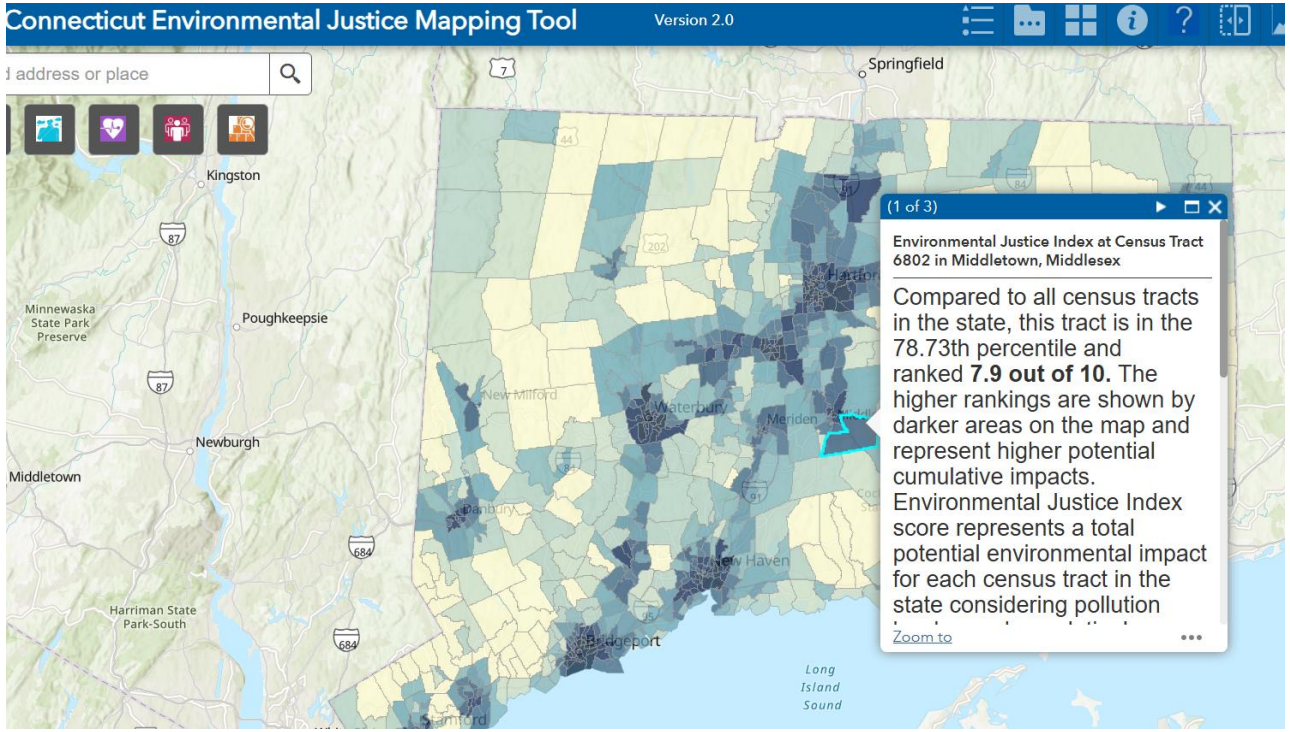
Examples

CDC SVI

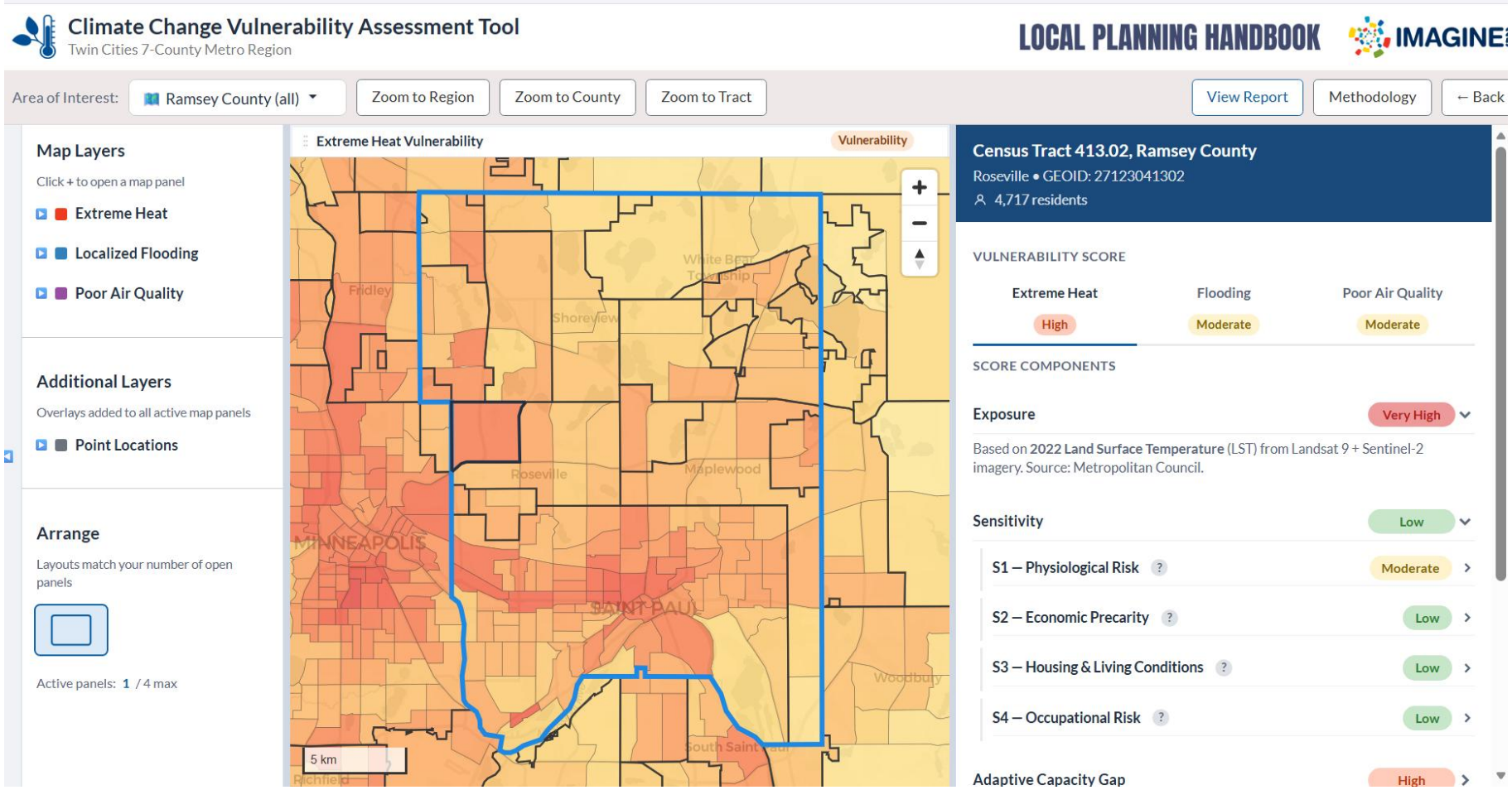


CT EJ SCREEN TOOL



Examples

CCVA



Potential Model

GOAL: Identify census tracts facing water-related burdens while considering social vulnerability and equity layers across the metro region.

- Affordability
- Quality
- Access
- Recreation & Benefits
- Infrastructure

*** Align with water equity opportunity brief

Where are the areas that currently face major water related challenges?

- Physiological Risk
- Economic Precarity
- Housing and Living Conditions

*** Taken from CCVA sub-index

Where do communities face disadvantages that reduce their ability to cope or make them more exposed to water related stressors?

Relative Score (0-1)

Where do these overlap?

Methodology

- Variable Selection & Justification
- Normalization & Standardization

- Average Sum of Unweighted Raw Indicators

- Average Sum of Unweighted Sub-Indices

- Average Sum of Unweighted Major Indices: Water Stress and Social Vulnerability

- Based on Score Range Classify: Very Low/ Low/ Moderate/ High/ Very High

Methodology Example:

Major Index 1

Water Related Stressors Score = 0.43

$$WRSS = \frac{Aff + Qual + Access + Rec}{4}$$

Affordability	0.85	Quality	0.3	Access	0.3	Recreation & Benefits	0.3
Water Cost Burden	0.85	Drinking Water Supply Vulnerability	0.3	Private Well Dependency	0.4	Distance to Public Shoreline Access	0.2
		Lead Service Lines	0.3	Service Gaps	0.2	Distance to River/Lake park	0.4

All raw indicators are first normalized and standardized through winsorization and min-max scaling (0-1 Scale)

Methodology Example:

Major Index 2:

Social Vulnerability Score = 0.48

$$SVS = \frac{Phy + Econ + Hous}{3}$$

Physiological Risk	0.36	Economic Precarity	0.8	Housing and Living Conditions	0.3
64 and Older	0.6	Below 185 % Poverty	0.8	Mobile Home	0.2
Under 5	0.3	Uninsured	0.9	Crowded Housing	0.2
With Disability	0.2	Housing Cost Burdened	0.8	Renter	0.5

All raw indicators are first normalized and standardized through winsorization and min-max scaling (0-1 Scale)

Methodology Example:

Composite Index Score: Water Vulnerability Index

$$water\ vulnerability\ index = (water\ related\ stressors * 0.5) + (social\ vulnerability * 0.5)$$

Water Related Stressors Score = 0.43

Social Vulnerability Score = 0.48

Water Vulnerability Index Score = 0.45

Census Tract A = Moderate Water Vulnerability

The sub-indices that scored the highest: economic precarity and affordability
Possible Interventions: water bill assistance programs/ targeted outreach to vulnerable households.

Composite Index Matrix

	Social Vulnerability - - >					
Water Stress | | v		**Very Low**	**Low**	**Moderate**	**High**	**Very High**
	Very Low	Very Low	Very Low	Low	Low	Moderate
	Low	Very Low	Low	Low	Moderate	Moderate
	Moderate	Low	Low	Moderate	Moderate	High
	High	Low	Moderate	Moderate	High	Very High
	Very High	Moderate	Moderate	High	Very High	Very High

Categories and Interpretation

Score	Category	Interpretation
0–20	Very Low	Limited water-related burdens and relatively low social vulnerability.
20–40	Low	Minor water-related burdens and moderate social vulnerability factors.
40–60	Moderate	Presence of either elevated water stress, elevated social vulnerability or both relatively moderate.
60–80	High	Significant overlap of water-related stressors and social vulnerability.
80–100	Very High	Communities experiencing major water-related burdens alongside high social vulnerability.

Water Vulnerability Index

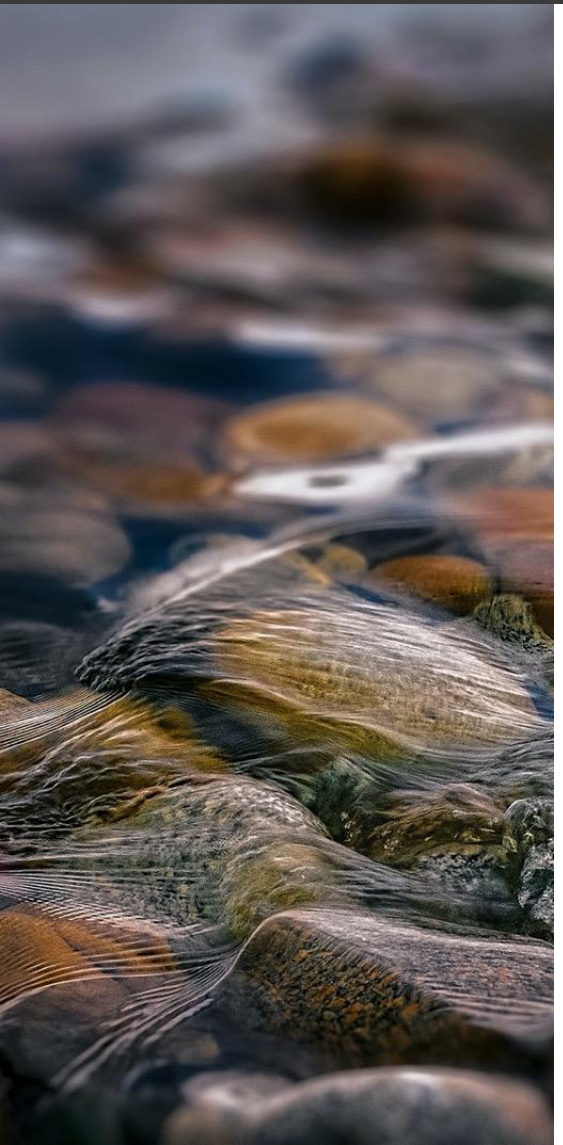
Strengths

- Can summarize multi-dimensional realities into a single score
- Easy to interpret, sub-indexes allow themes to focus/ develop planning signals
- Provide multilayered context for an area

Limitations

- Weights and indicator selection might be subject to bias
- Data availability can constrain inclusion of water metrics
- Not focused on specific challenge, broad exploratory tool
- Census tract aggregation may mask within-tract variability
- Place-based tool that needs further community consultation

Review and input requested



Questions/ Comments on Tool's Scope & Framework

• Do you see this tool addressing a meaningful gap in water planning and equity work?

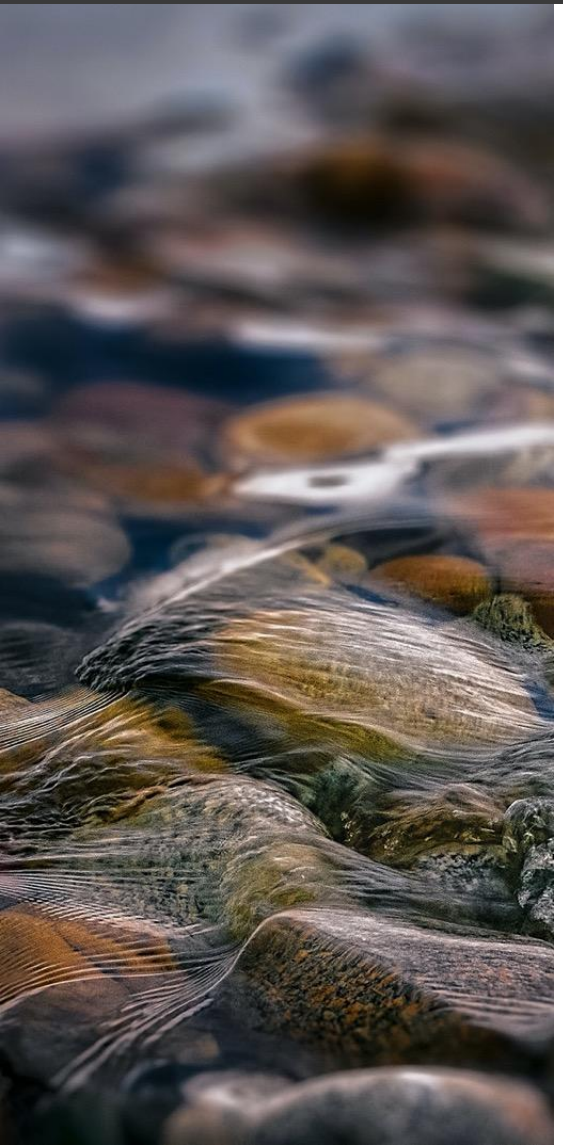
•If a map like this existed today, how and when would you use it in your work?

•What decisions could this tool realistically inform?

•Are there any water related challenges you would be most compelled to learn from this tool?

•Which audience would you like this tool to reach? What are important things to consider according to that audience target?

Review and input requested

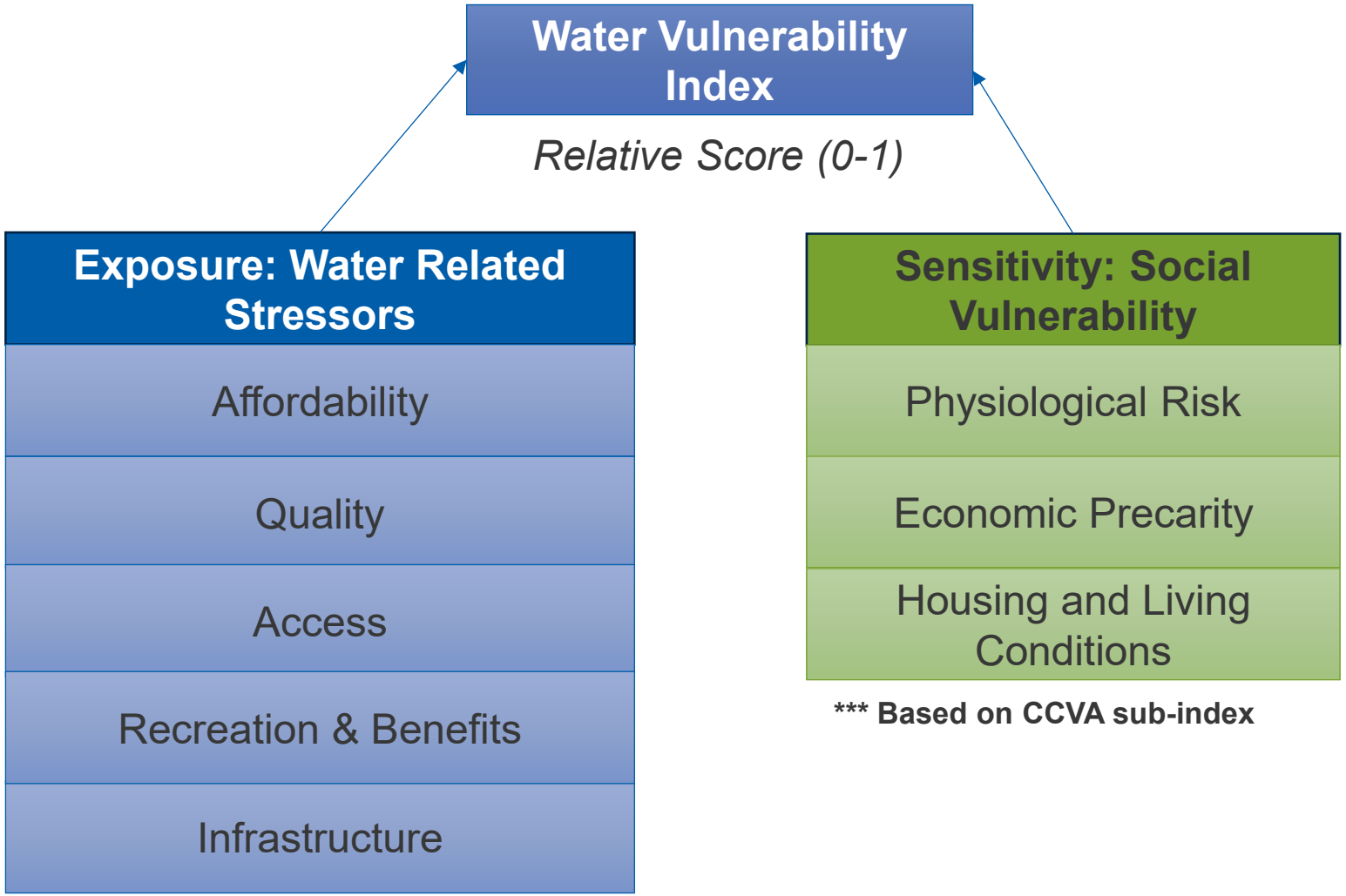


Questions/ Comments on Tool's Methodology

- What are some of the challenges you might foresee on the methodology?
- What would you need to trust and confidently interpret the results?
- Are there any other tools and/or methodologies you think could work better for screening water equity instead?

Summary Slide

GOAL: Identify census tracts facing water-related burdens while considering social vulnerability and equity layers across the metro region.



*** Based on CCVA sub-index

*** Align with water equity opportunity brief

Planning Context Layers

- Historical Systemic Disparities
- Actionability
- Cultural Relevance

Process Check

What have I been working on?

- Methodology Report Draft
- Presentations and Feedback
- Connecting with other agencies to ask about similar work
- Feedback Research on Scope and Framework – EJ Playbook alignment
- Data Mining for Proxies for Each Theme – Dataset Inventory
- Running Trials in R adapting CCVA's code into the Water Vulnerability Index

Thank you

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