



Floodplain Vulnerability Assessment

Board Workshop #2

June 4, 2024



Forest Lake Wild Rice



Workshop Objectives

Confirm Mapping

Presentation on revised mapping per feedback from last workshop and latest meeting with city engineers.

Gain Consensus on Priority Ranking & Modeling Subsheds

Moved Pollution Sensitivity of Near Surface Materials to environmental category. Even priority ranking for environmental vs infrastructure vs social vs flood hazard.

Next Steps

Review next steps in planning process, including Community Engagement



Meeting with City Engineers

City engineers recommendations/feedback:

1. Equally prioritize environmental, social, and infrastructure factors in planning
2. Cities' top priority = roadway projects and reacting to reports of localized flooding
3. City of Forest Lake is 75% finished with highly detailed hydrologic model for its downtown area
4. Cities haven't worked with private companies on projects outside of mandated ordinance/rule enforcement
5. Hold Community Engagement Workshops and invite city staff (and other community members) prior to holding joint board-council workshops

ENVIRONMENTAL

- Pollution Sensitivity of Near Surface Materials
- Impaired Waters
- Native Plant Communities Connected with Groundwater
- Soil Erosion Risk
- MN Biological Survey Sites of Biodiversity Significance

INFRASTRUCTURAL

- Critical Infrastructure
- Emergency Routes
- Roadways



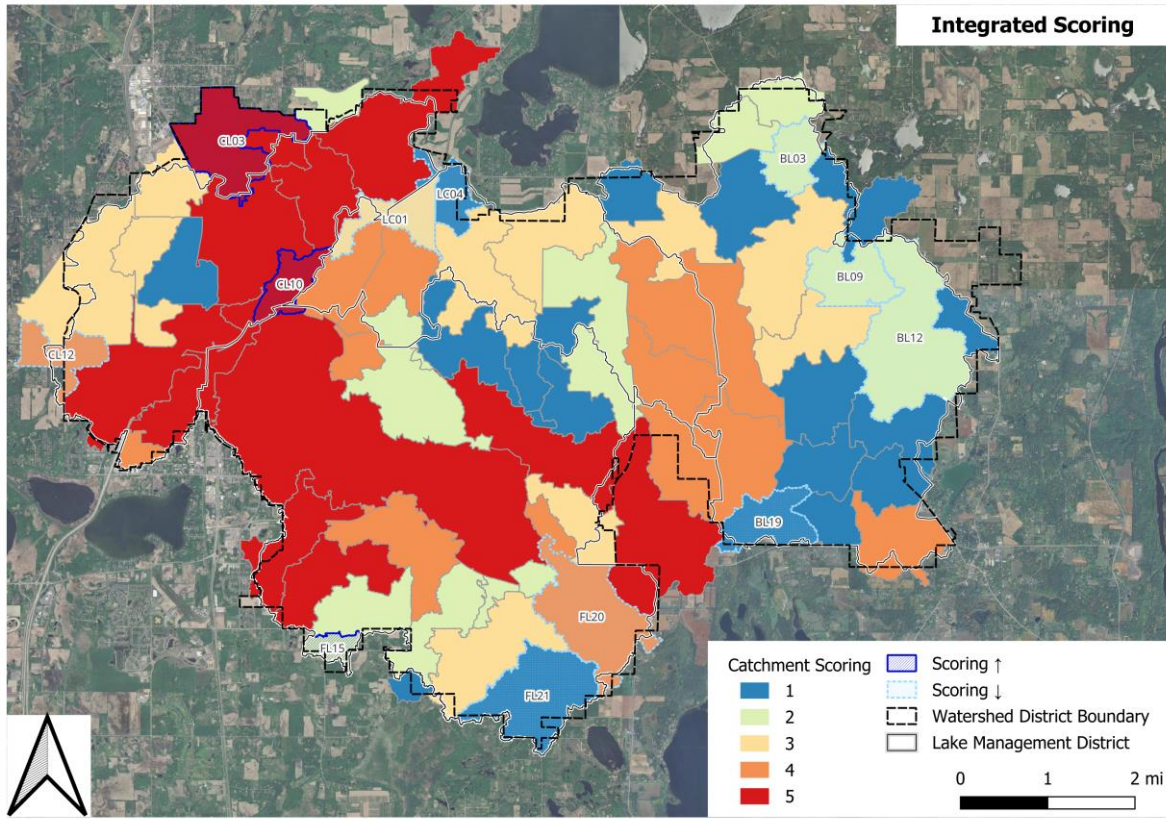
SOCIAL

- Parks/Trails
- Buildings
- Social Vulnerability Layer (based on census data)

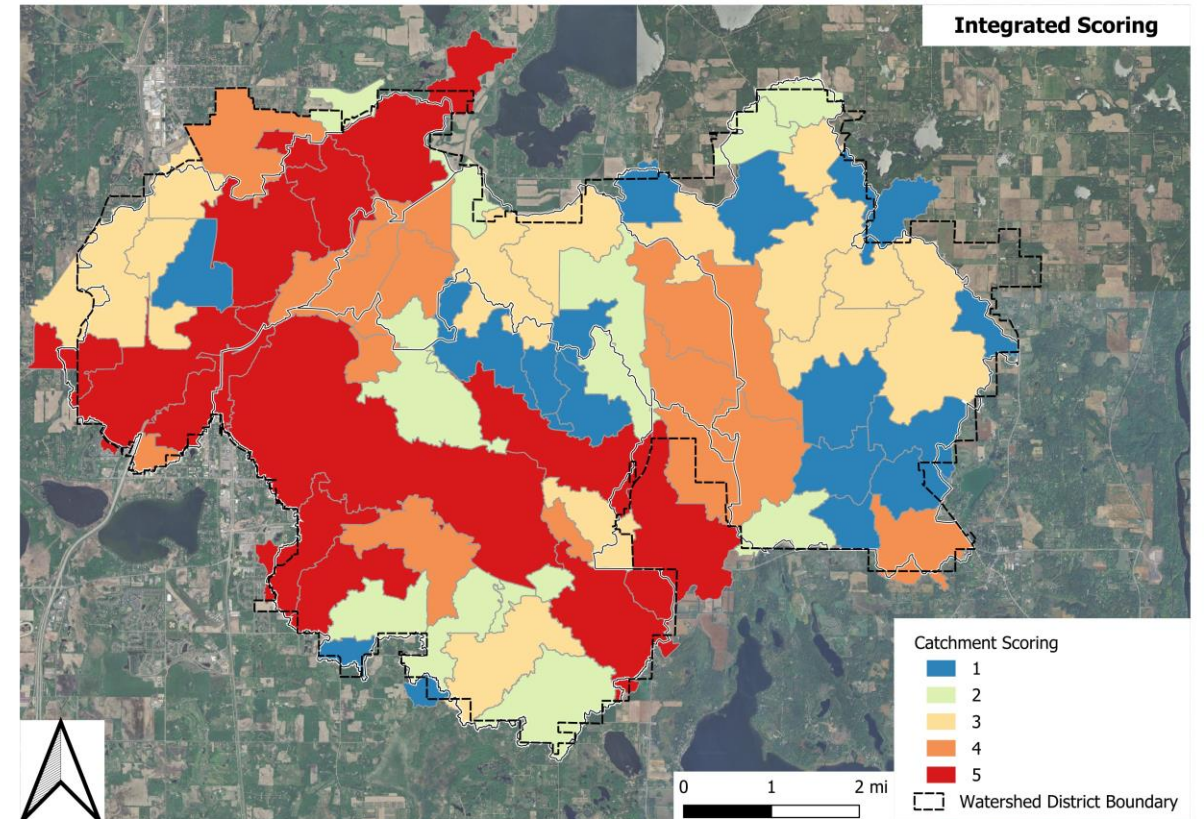
FLOOD HAZARD

- Slope
- Imperviousness
- Distance to Streams
- Height Above Nearest Drainage

Integrated Scoring - COMPARISON

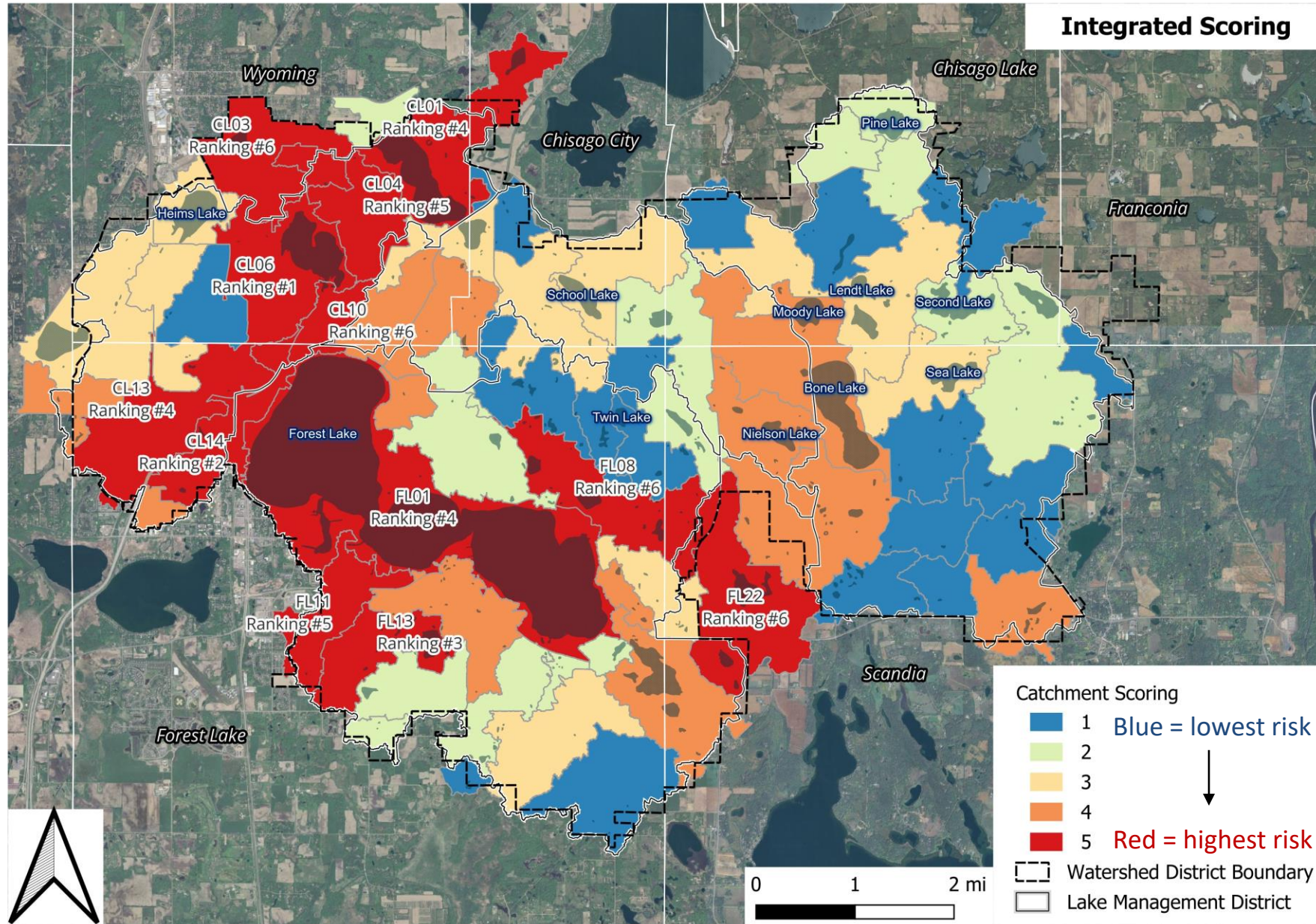


Revised Version

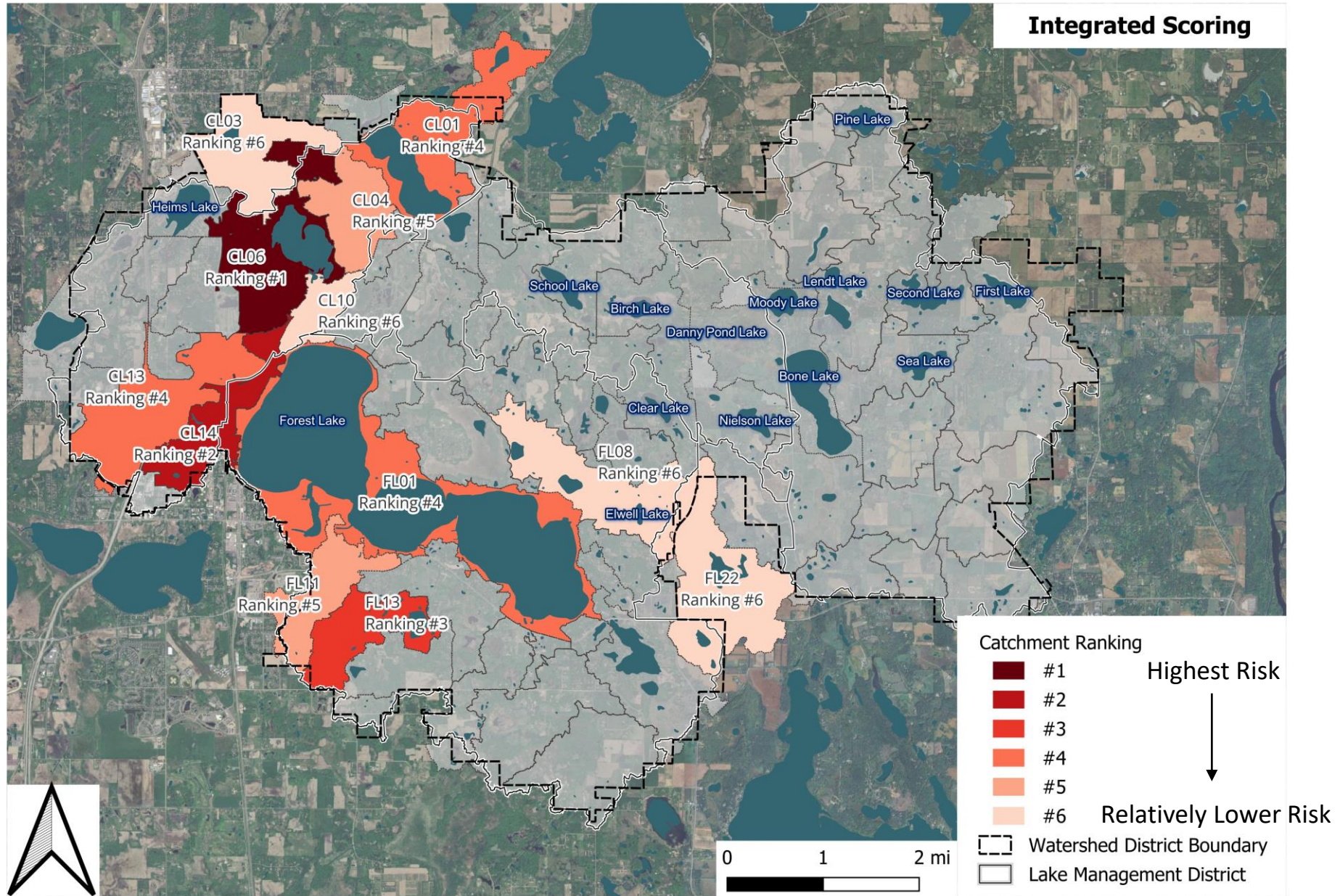


Original Version

Integrated Scoring (as revised)



Integrated Scoring (red catchments only)





Recommended Approach for Community Engagement Phase

Preparations:

- Solidify the integrated map, but consider changing focus/priorities if a very compelling case is made (e.g., turn an orange into a red if there's a major factor that we missed).
- Otherwise, our main focus is on the red subwatersheds, and more specifically on the top ranked reds (the reddest of the reds).
- EOR perform modeling exercise in one of the reddest reds (discuss which one) so we can see what that looks like



Recommended Approach for Community Engagement Phase

During the workshops/surveys:

- **Community Engagement Goals:**

1. Get feedback and buy-in on the prioritization
2. Have the community identify gaps in our prioritization methodology, and the District will assess the validity of those gaps
3. Get feedback on the types of projects we'll ultimately do in those priority areas; lay the groundwork and generate support for future District capital improvement projects



Recommended Approach for Community Engagement Phase

During the workshops/surveys:

- Intro/background why this is important (e.g., climate change slides)
- Present to the community why the red areas are the highest risk (explain what went into the mapping exercise). Get buy-in on our prioritization done to date
- Ask what other factors are at play in the watershed, specifically the red subwatersheds (is there anything missing from our list of factors?)
- Present potential flood mitigation strategies (flood storage projects, protecting green space to preserve infiltration to groundwater, enforcing local rules and ordinances) and explain multiple benefits and potential partnerships
- Solicit feedback on support for various types of practices (do people support green infrastructure/greenway corridor approach which provides multiple benefits vs “just build a big storage pond and be done with it”)



Community Engagement Roles & Responsibilities

- **CLFLWD Managers:** *lead decision-making* – gain consensus on priorities prior to workshops, prioritize based on feedback after workshops
- **CLFLWD Staff:** *lead coordination* – scheduling, location, invites
- **EOR:** *lead technical* – presentation of maps and data, answer technical questions
- **Zan Associates:** *lead facilitation* – write engagement plan w/ input from CLFLWD, perform audience analysis, lead discussions during workshops to solicit feedback
 - Dan Pfeiffer from Zan Associates will join midway through the June 4th workshop to give an introduction



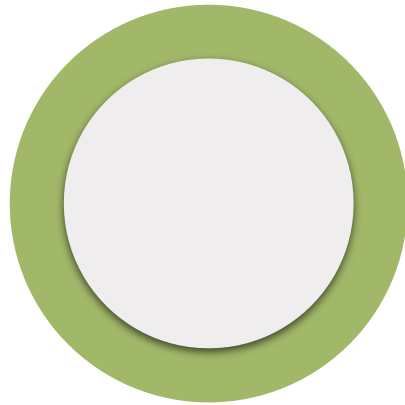
Recommended Next Steps & Approximate Timetable

June/July	<ul style="list-style-type: none"> • Consider Zan Associates proposal at June 13th regular board meeting • Contracting with Zan Associates
July/August	<ul style="list-style-type: none"> • Decisions announced for two grants CLFLWD applied for • Zan Associates available to begin work in late July: perform equity analysis, finalize outreach plan • Set dates for workshops and begin preparing flyers/invites
August	<ul style="list-style-type: none"> • Hold workshop #1
September	<ul style="list-style-type: none"> • Report back to board
September/ October	<ul style="list-style-type: none"> • Hold workshop #2
October/ November	<ul style="list-style-type: none"> • Report on community engagement findings to Board • Consider modeling highest priority subwatersheds • Begin writing final report for Floodplain Vulnerability Assessment
December/ January	<ul style="list-style-type: none"> • Approve final report • Begin next phase of work: project targeting within top priority modeled subwatersheds
January	<ul style="list-style-type: none"> • Apply for grants to fund feasibility, design, and project construction



Reference slides

ENVIRONMENTAL



Pollution
Sensitivity of
Near-Surface
Materials

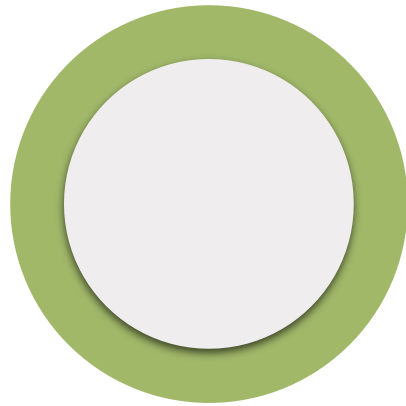
Impaired Waters

Native Plant
Communities
Connected with
Groundwater

Soil Erosion Risk

Minnesota
Biological Survey
(MBS) Sites of
Biodiversity
Significance

ENVIRONMENTAL



**Pollution
Sensitivity of
Near-Surface
Materials**

**Impaired
Waters**

**Native Plant
Communities
Connected with
Groundwater**

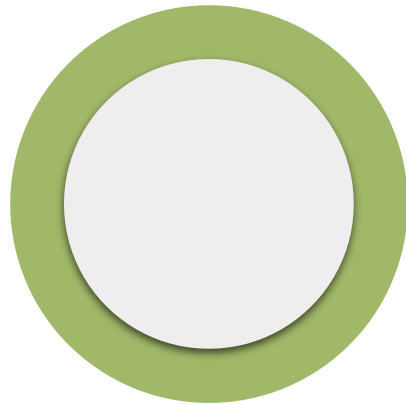
Soil Erosion Risk

**MBS Sites of
Biodiversity
Significance**

Pollution Sensitivity of Near-Surface Materials

- **Source:** DNR
- **Description:** This dataset estimates the pollution sensitivity of near-surface materials from the transmission time of water through 3 feet of soil and 7 feet of surficial geology, to a depth of 10 feet from the land surface.
- **Publication:** 2018-10-31
- **Scoring Process:** Score the pollution sensitivity index from 1 to 5 based on its geologic sensitivity rating, calculate the average sensitivity index within each catchment, and then categorize it into a 1 to 3 scoring system based on quartiles.

ENVIRONMENTAL



Pollution
Sensitivity of
Near-Surface
Materials

**Impaired
Waters**

Native Plant
Communities
Connected with
Groundwater

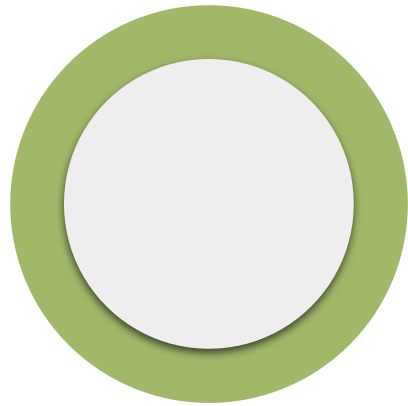
Soil Erosion Risk

MBS Sites of
Biodiversity
Significance

Impaired Lakes/Streams

- **Source:** MPCA
- **Description:** Impaired waterbodies as determined by MPCA's surface water quality assessment process for the 2022 reporting cycle to US Environmental Protection Agency (EPA).
- **Publication:** 2022-05-04
- **Scoring Process:** Impaired Lakes/Streams intersect with the catchments. They are quantiled based on the area or length in each catchment, with scores ranging from 1 to 3.

ENVIRONMENTAL



Pollution
Sensitivity of
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Materials

Impaired
Waters

**Native Plant
Communities
Connected with
Groundwater**

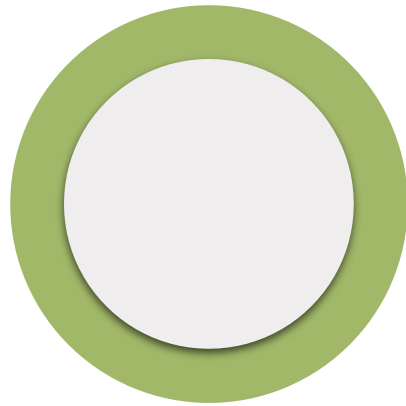
Soil Erosion Risk

MBS Sites of
Biodiversity
Significance

Native Plant Communities Connected with Groundwater

- **Source:** DNR
- **Description:** The basic units of classification are the wetland native plant communities (NPC) as described in the series of Field Guides to the Native Plant Communities of Minnesota (MnDNR 2005a, 2005b, 2003). The NPCs are grouped into readily recognizable wetland type categories.
- **Publication:** 2019-01-18
- **Scoring Process:** Scoring the NPC index from 1 to 5 based on its type of groundwater dependence, calculating the average NPC index within each catchment, and then categorizing it into a 1 to 3 scoring system based on quartiles.

ENVIRONMENTAL



Pollution
Sensitivity of
Near-Surface
Materials

Impaired
Waters

Native Plant
Communities
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Groundwater

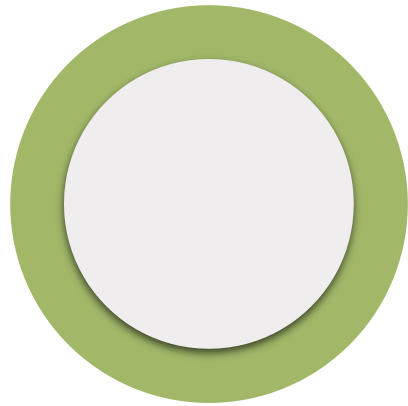
Soil Erosion Risk

MBS Sites of
Biodiversity
Significance

Soil Erosion Risk

- **Source:** BWSR
- **Description:** This data layer represents a general risk score for potential soil erosion on a 0-100 point scale, 100 being the highest risk. Larger values indicate soils that have a higher potential to erode if no conservation practices were in place and overland sheet or rill runoff was present.
- **Scoring Process:** Calculate the average soil erosion risk score within each catchment, and then categorize it into a 1 to 3 scoring system based on quartiles.

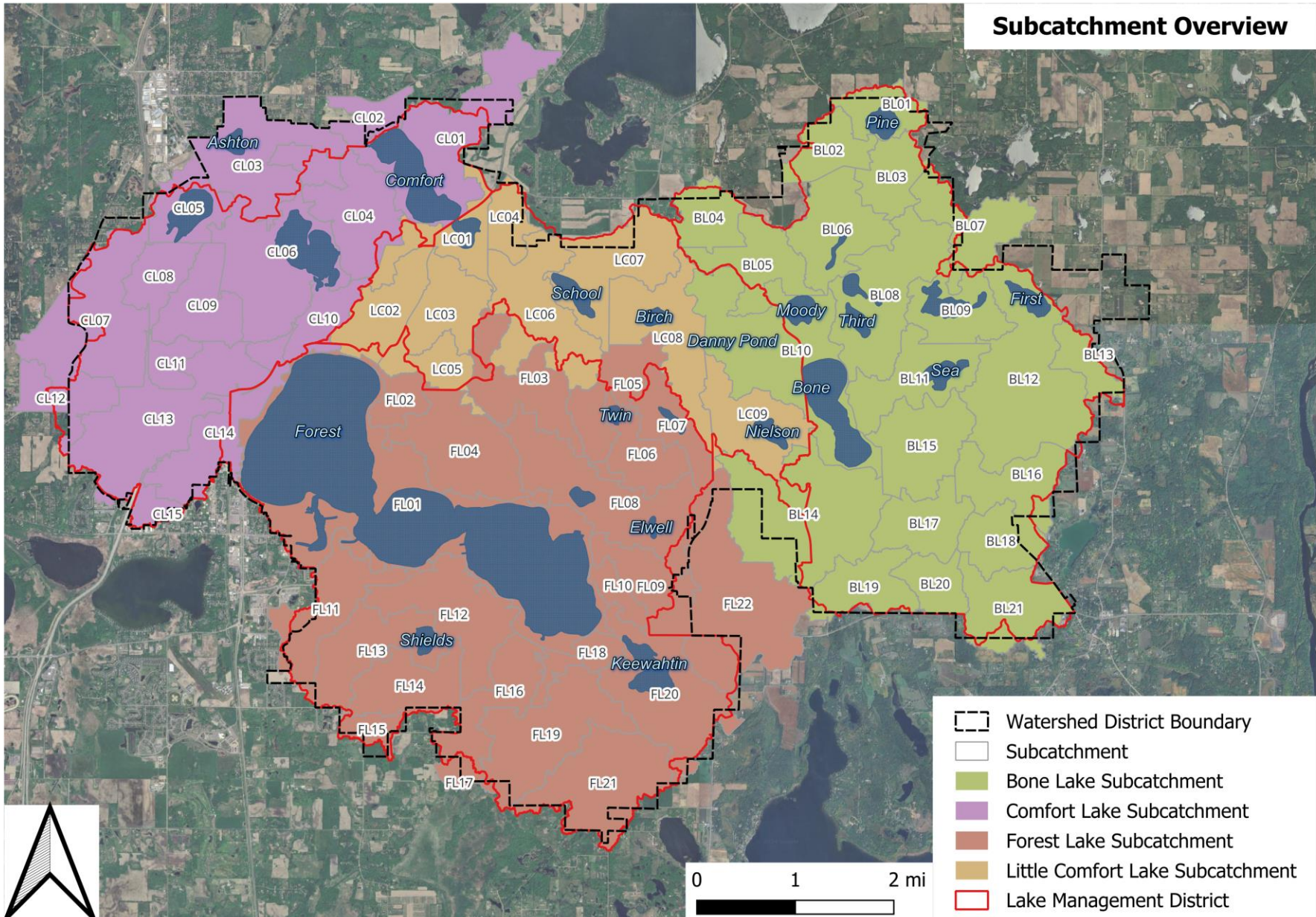
ENVIRONMENTAL



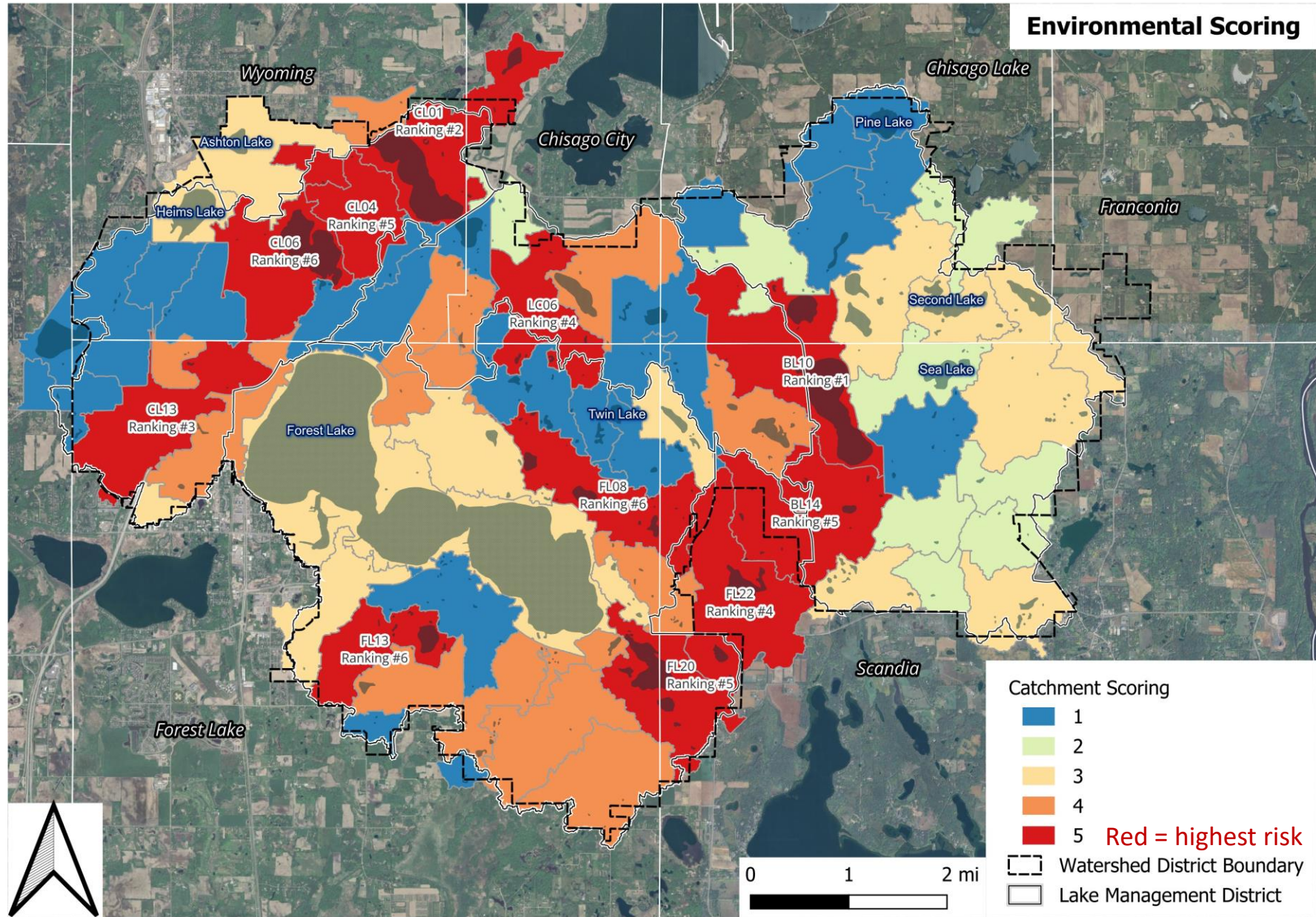
- Pollution Sensitivity of Near-Surface Materials
- Impaired Waters
- Native Plant Communities Connected with Groundwater
- Soil Erosion Risk
- MBS Sites of Biodiversity Significance**

MBS Sites of Biodiversity Significance

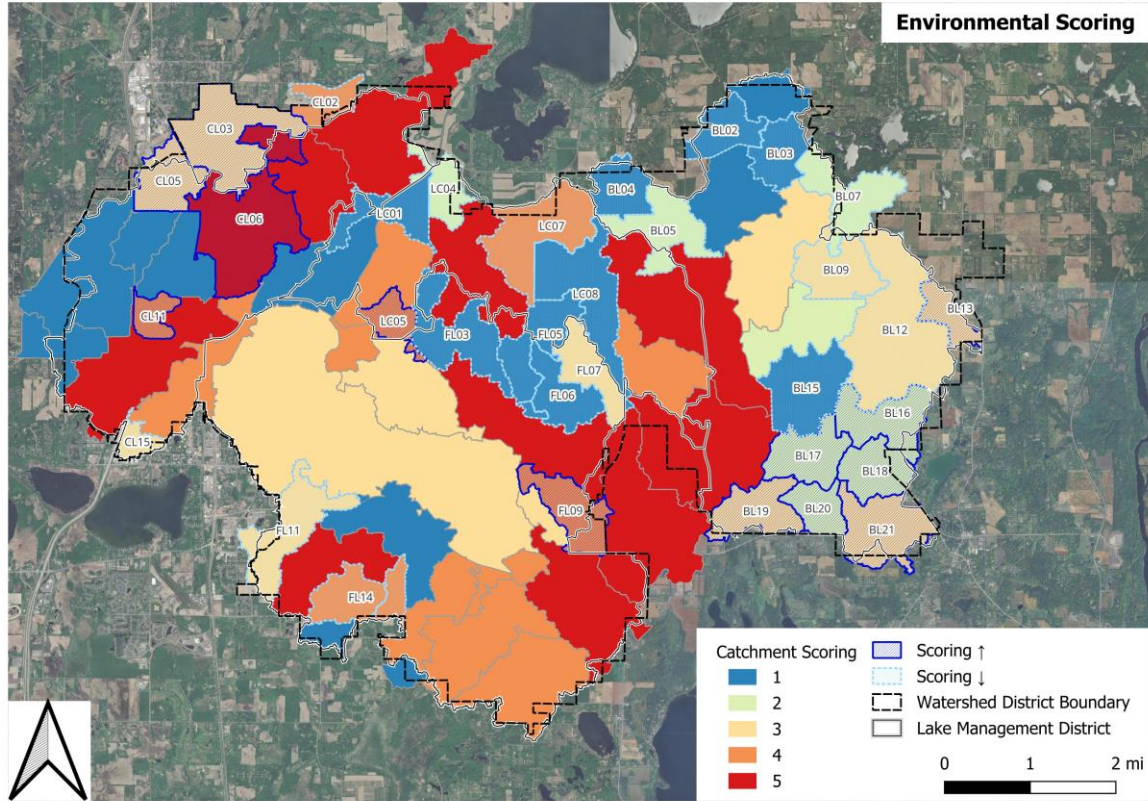
- **Source:** DNR
- **Description:** This data layer represents areas with varying levels of native biodiversity that may contain high quality native plant communities, rare plants, rare animals, and/or animal aggregations.
- **Publication:** 2023-09-07
- **Scoring Process:** Score the biodiversity significance index from 1 to 4 based on its biodiversity significance rank, calculate the average significance index within each catchment, and then categorize it into a 1 to 3 scoring system based on quartiles.



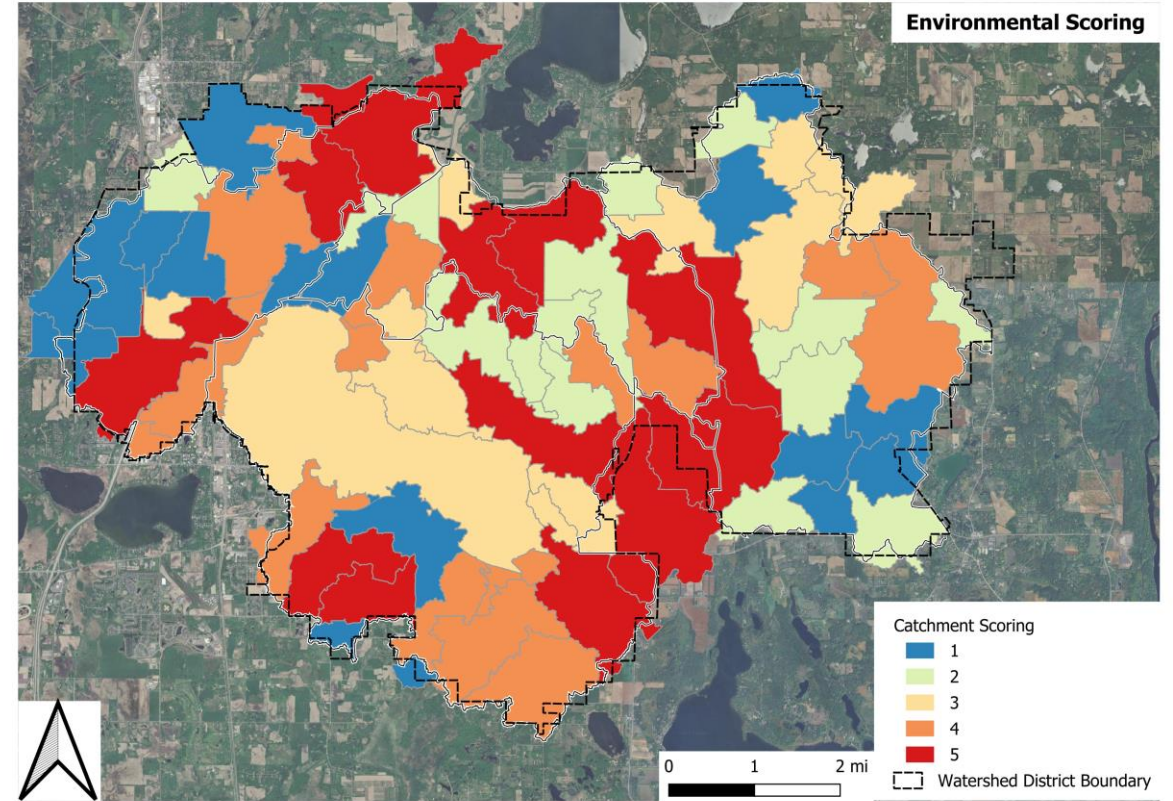
Environmental Scoring



Environmental Scoring – COMPARISON



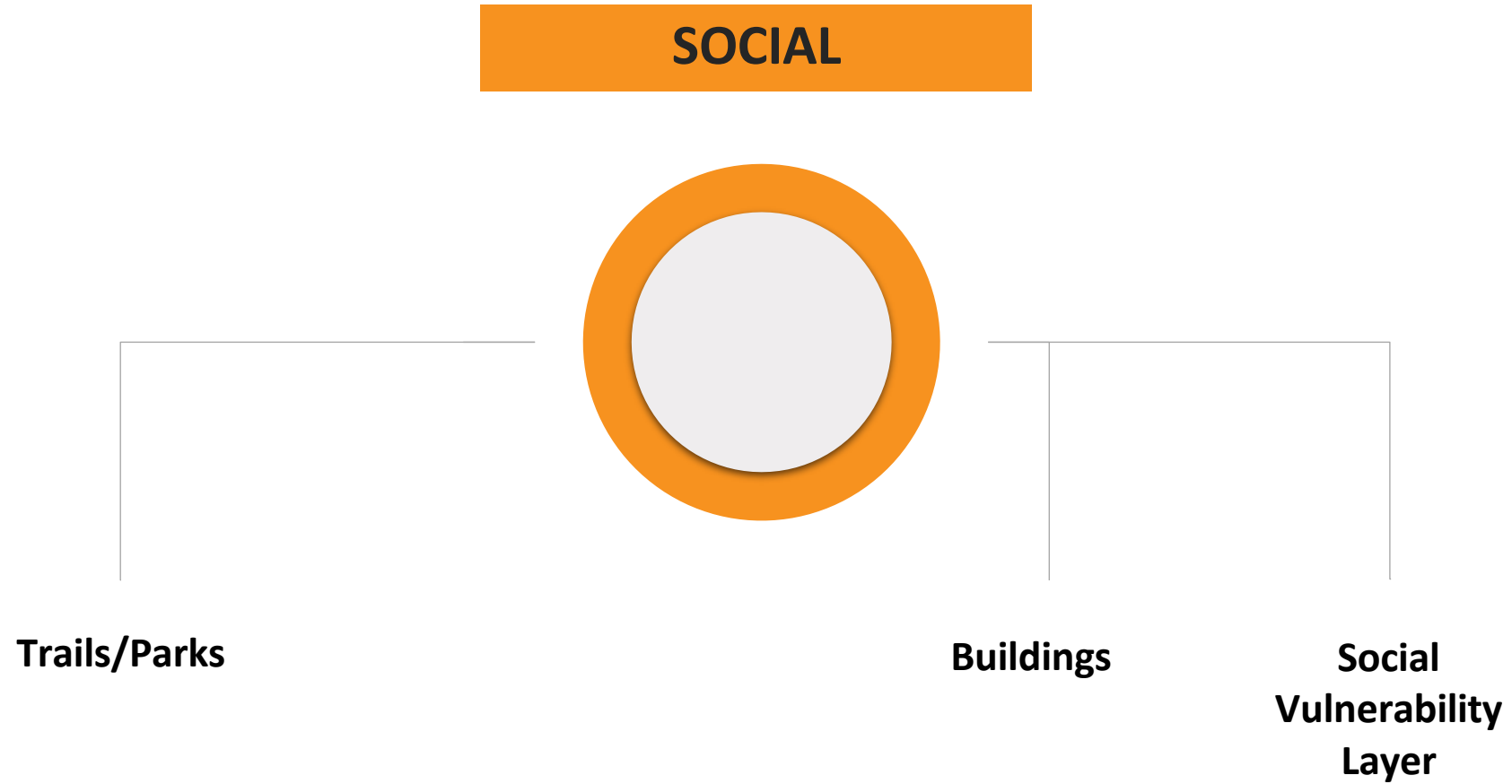
Revised
Version w/ Pollution Sensitivity of near surface materials



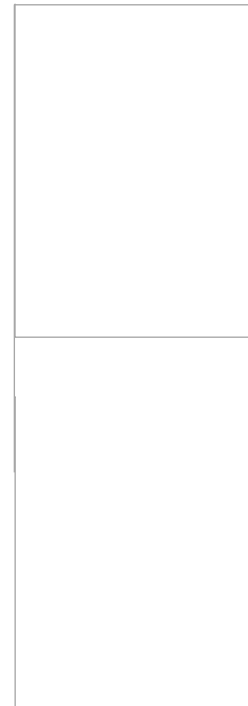
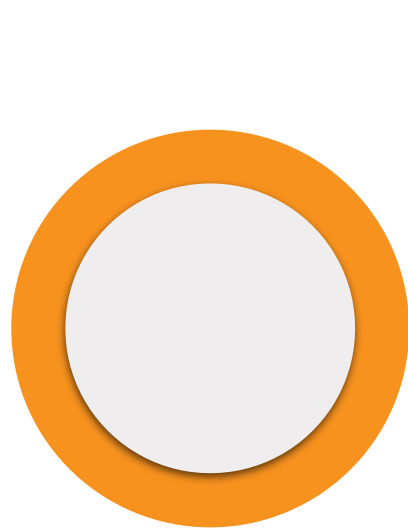
Original
Version w/o Pollution Sensitivity of near surface materials

Environmental Scoring – COMPARISON (*to previous version*)

(# of subcatchments)	Score 5 - Highest Risk		Score 4 - High Risk		Score 3 - Medium Risk		Score 2 - Low Risk		Score 1 - Very Low Risk		Average Score	
	original	revised	original	revised	original	revised	original	revised	original	revised	original	revised
LMD	original	revised	original	revised	original	revised	original	revised	original	revised	original	revised
Comfort Lake	4	4	3	3	1	3	1	0	6	5	3.14	3.48
Little Comfort Lake	2	1	2	4	2	0	2	1	1	3	3.46	3.06
Forest Lake	5	4	7	7	4	5	3	0	3	6	3.56	3.40
Bone Lake	2	2	2	0	4	6	7	7	6	6	2.98	2.82
Total	13	11	14	14	11	14	13	8	16	20	3.29	3.20



SOCIAL



Trails/Parks

Buildings

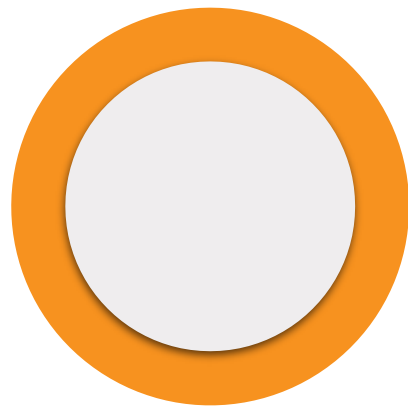
**Social
Vulnerability
Layer**

Trails/Parks

- **Source:** Proposed Greenway Strategy Presentation
- **Description:** This data layer was manually created based on a trails/parks priority map from the Proposed Greenway Strategy Presentation.
- **Scoring Process:** Count the number of trails and parks in each catchment and assign a score from 1 to 3 based on the quantile for catchments with trails or parks. Assign a score of 0 to catchments without any trails or parks.

Note: Due to its overlapping information with drinking water quality, private well locations, and aquifer vulnerability layers, only this layer is used here for scoring.

SOCIAL



Trails/Parks

Buildings

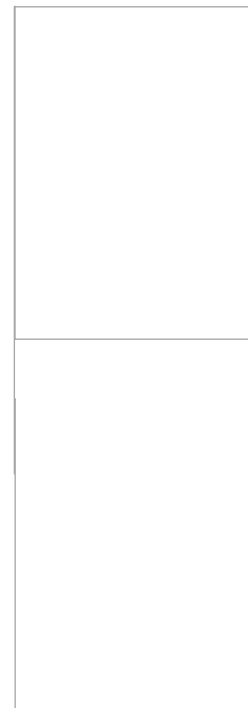
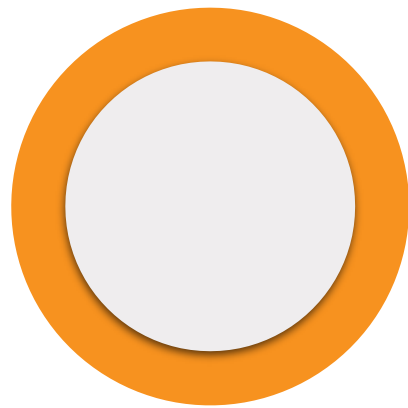
Social
Vulnerability
Layer

Buildings

- **Source:** FEMA
- **Description:** This layer is created using structure (building) polygons (exclude any critical infrastructure) for the state of Minnesota
- **Scoring Process:** Count the number of buildings within each catchment and assign a score from 1 to 3 based on the quantile of the numbers. Assign a score of 0 to catchments without any buildings in the floodplain.

Note: Due to its overlapping information with drinking water quality, private well locations, and aquifer vulnerability layers, only this layer is used here for scoring.

SOCIAL



Trails/Parks

Buildings

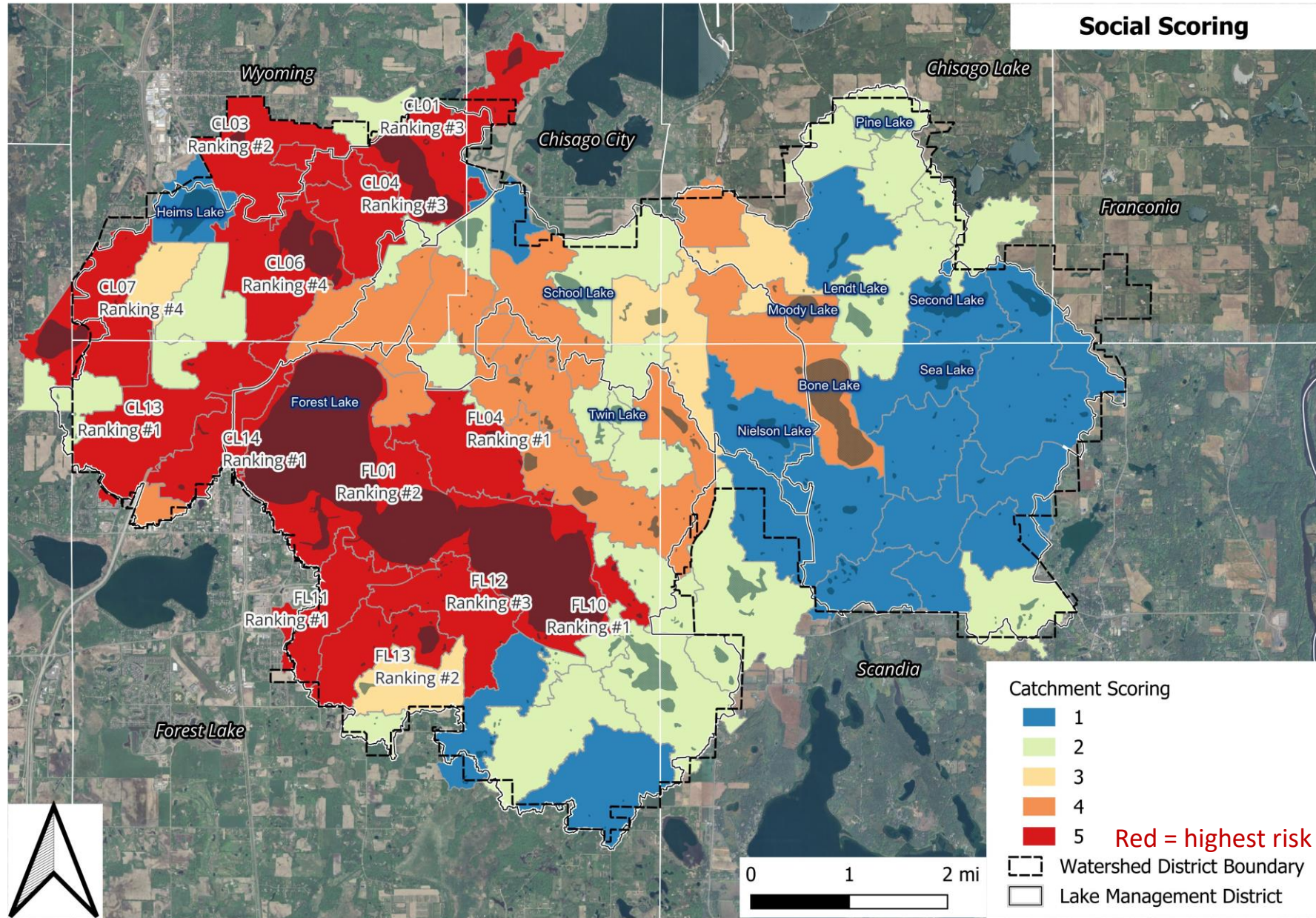
**Social
Vulnerability
Layer**

Social Vulnerability Layer

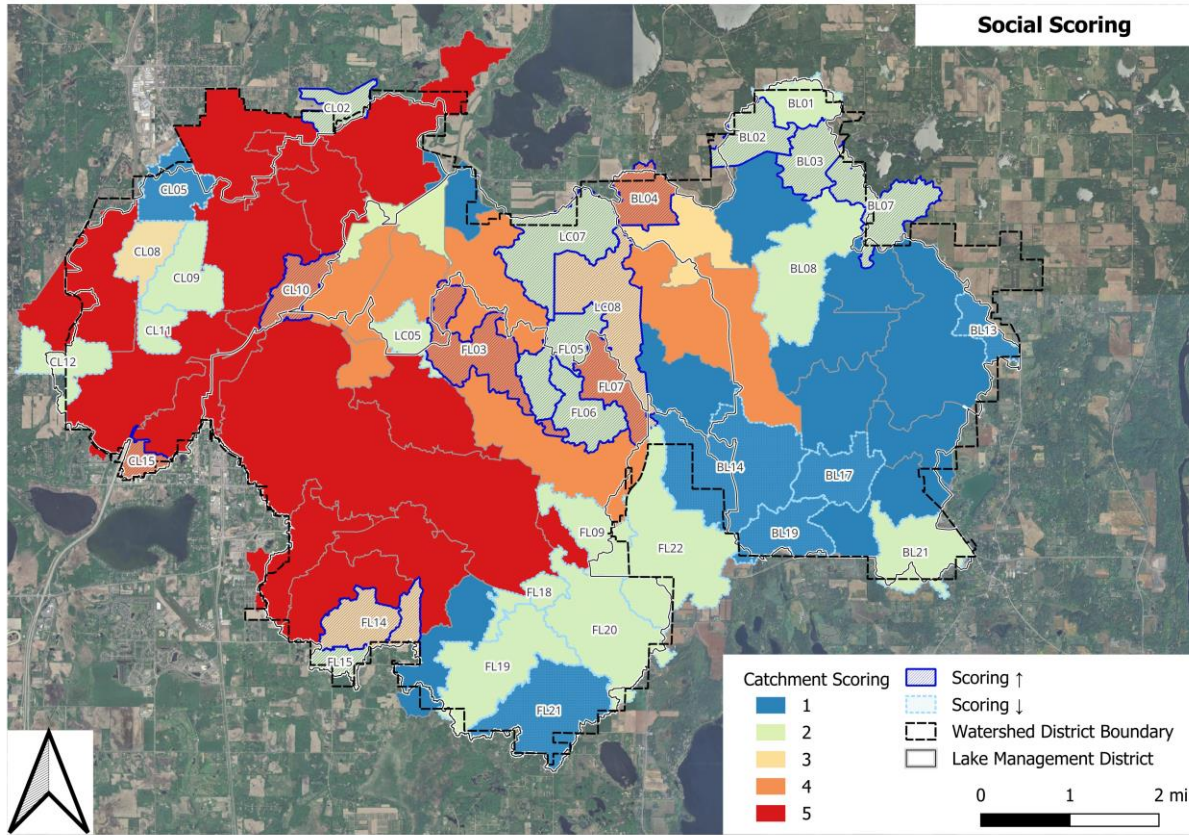
- **Source:** EOR
- **Description:** This data layer is created from a series of Census data, including 1) lone parents, 2) children aged 4 years and younger, 3) people aged 75 years and older, 4) population density, 5) renter households, 6) individuals below the poverty line, 7) individuals without a high school diploma, and 8) persons who speak English less than well.
- **Scoring Process:** The layer is indexed from 1 to 5, and the average is calculated within each catchment, after which it is categorized into a 1 to 3 scoring system based on quartiles.

Note: Due to its overlapping information with drinking water quality, private well locations, and aquifer vulnerability layers, only this layer is used here for scoring.

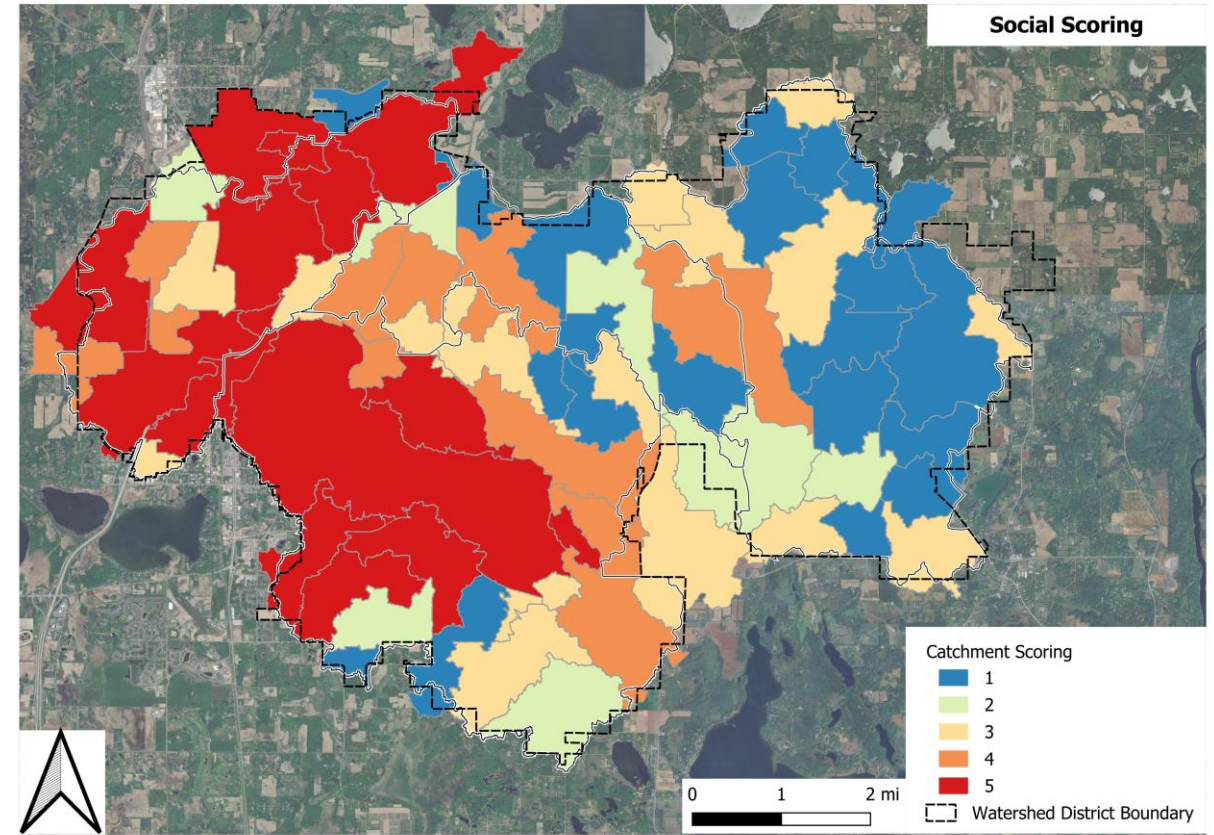
Social Scoring



Social Scoring - COMPARISON



Revised
Version w/o Pollution Sensitivity of near surface materials

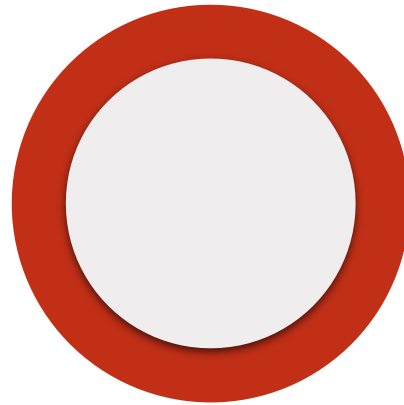


Original
Version w/ Pollution Sensitivity of near surface materials

Social Scoring – COMPARISON (*to previous version*)

(# of subcatchments)	Score 5 - Highest Risk		Score 4 - High Risk		Score 3 - Medium Risk		Score 2 - Low Risk		Score 1 - Very Low Risk		Average Score	
	original	revised	original	revised	original	revised	original	revised	original	revised	original	revised
LMD	original	revised	original	revised	original	revised	original	revised	original	revised	original	revised
Comfort Lake	7	7	3	2	3	1	1	4	1	1	4.47	4.29
Little Comfort Lake	0	0	3	3	1	1	2	3	3	2	2.48	2.75
Forest Lake	6	6	4	4	5	1	2	8	5	3	3.76	3.54
Bone Lake	0	0	1	2	7	1	2	6	11	12	2.05	1.78
Total	13	13	11	11	16	4	7	21	20	18	3.25	3.08

INFRASTRUCTURAL

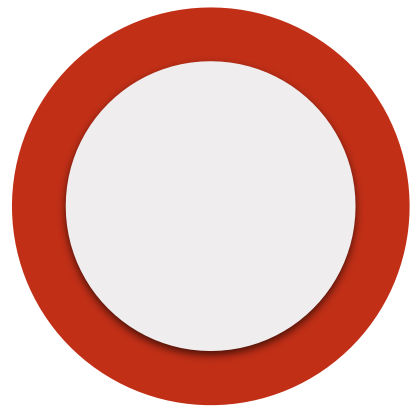


Critical
Infrastructure

Emergency Routes

Roadways

INFRASTRUCTURAL



**Critical
Infrastructure**

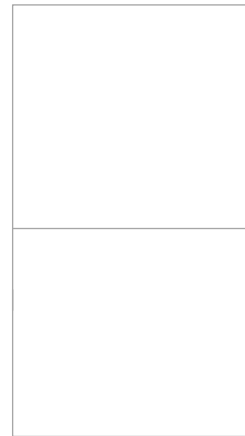
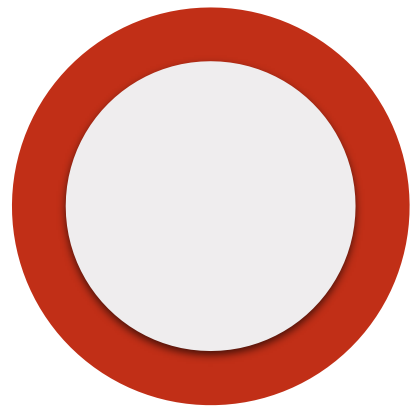
Emergency Routes

Roadways

Critical Infrastructure

- **Source:** EOR
- **Description:** This data layer is created based on the locations of fire departments, hospitals, places of worship, police stations, schools, electrical substations, and wastewater facilities.
- **Scoring Process:** Count the number of critical infrastructure facilities within each catchment and assign a score from 1 to 3 based on the quantile of critical infrastructure. Assign a score of 0 to catchments without any critical infrastructure.

INFRASTRUCTURAL



Critical
Infrastructure

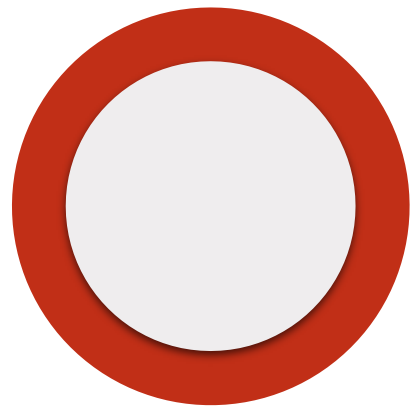
Emergency
Routes

Roadways

Emergency Routes

- **Source:** EOR
- **Description:** Truck routes was used as a proxy for emergency routes, which is estimated from the MnDOT road layer
- **Scoring Process:** The layer is intersected with each catchment to calculate its length, and then it is categorized into a 1 to 3 score based on quantiles.

INFRASTRUCTURAL



Critical
Infrastructure

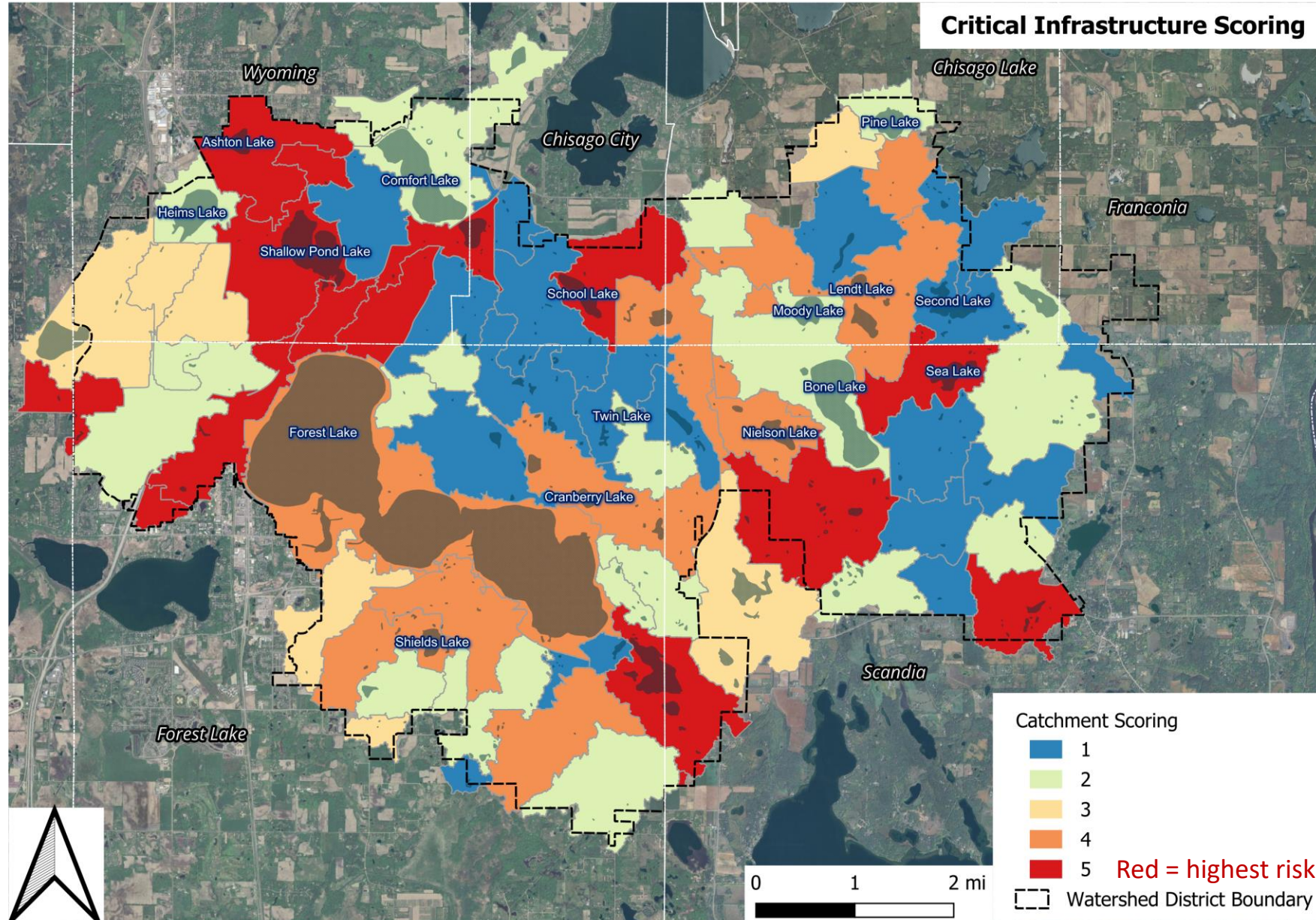
Emergency Routes

Roadways

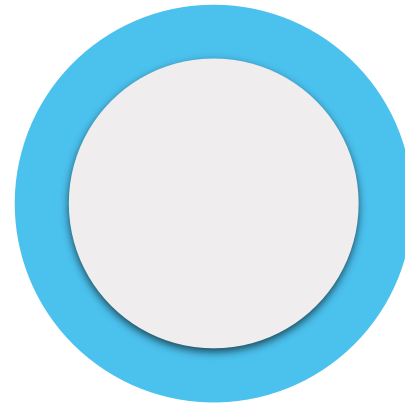
Roadways

- **Source:** EOR
- **Description:** This layer includes all the roadways, with the exception of the emergency routes.
- **Scoring Process:** The layer is intersected with each catchment to calculate its length, and then it is categorized into a 1 to 3 score based on quantiles.

Infrastructural Scoring



FLOOD HAZARD



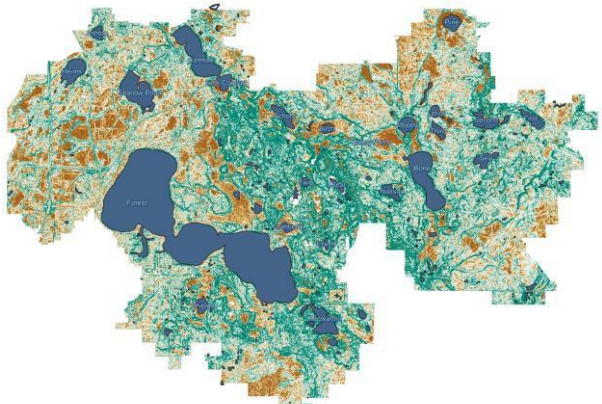
Slope

Imperviousness

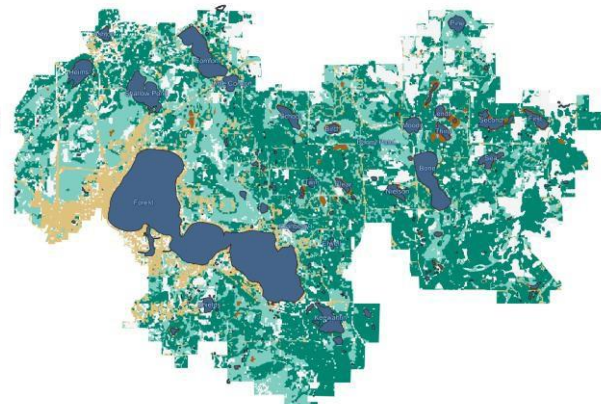
Distance to
Streams

Height above
Nearest Drainage

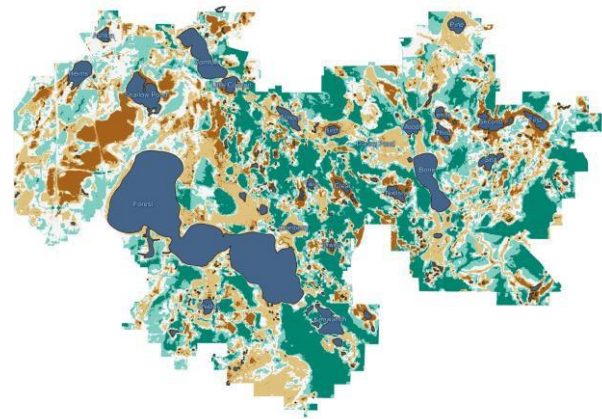
Flood Hazard Scoring



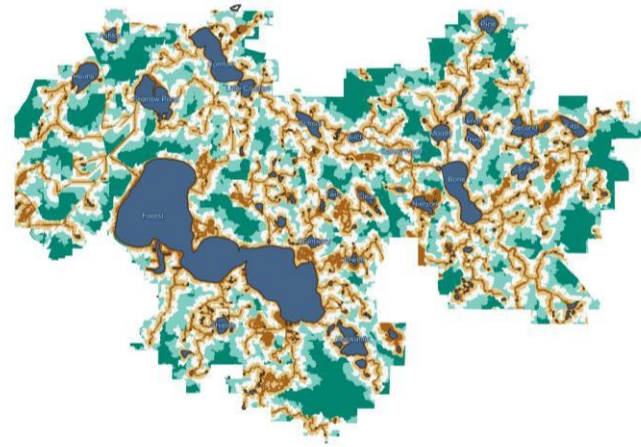
Slope



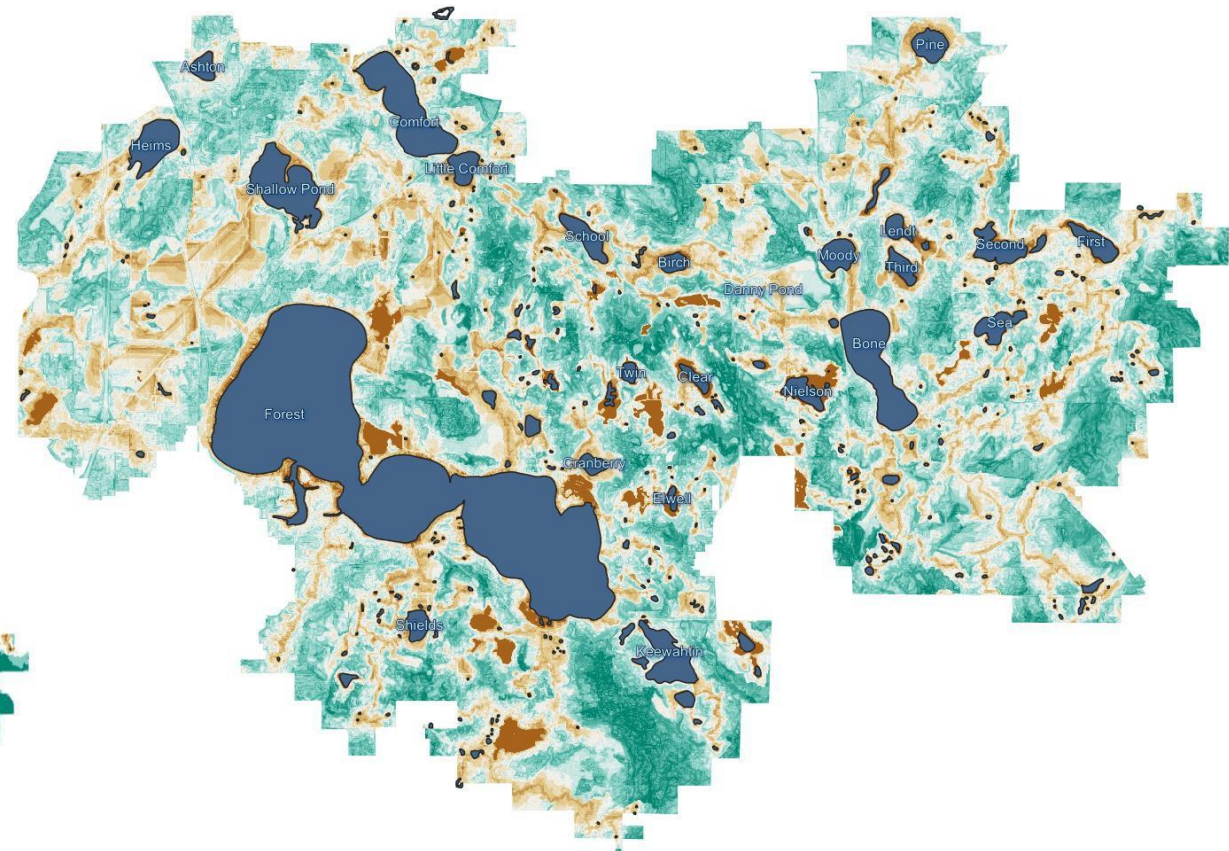
Curve Number



**Height Above Nearest
Drainage (HAND)**



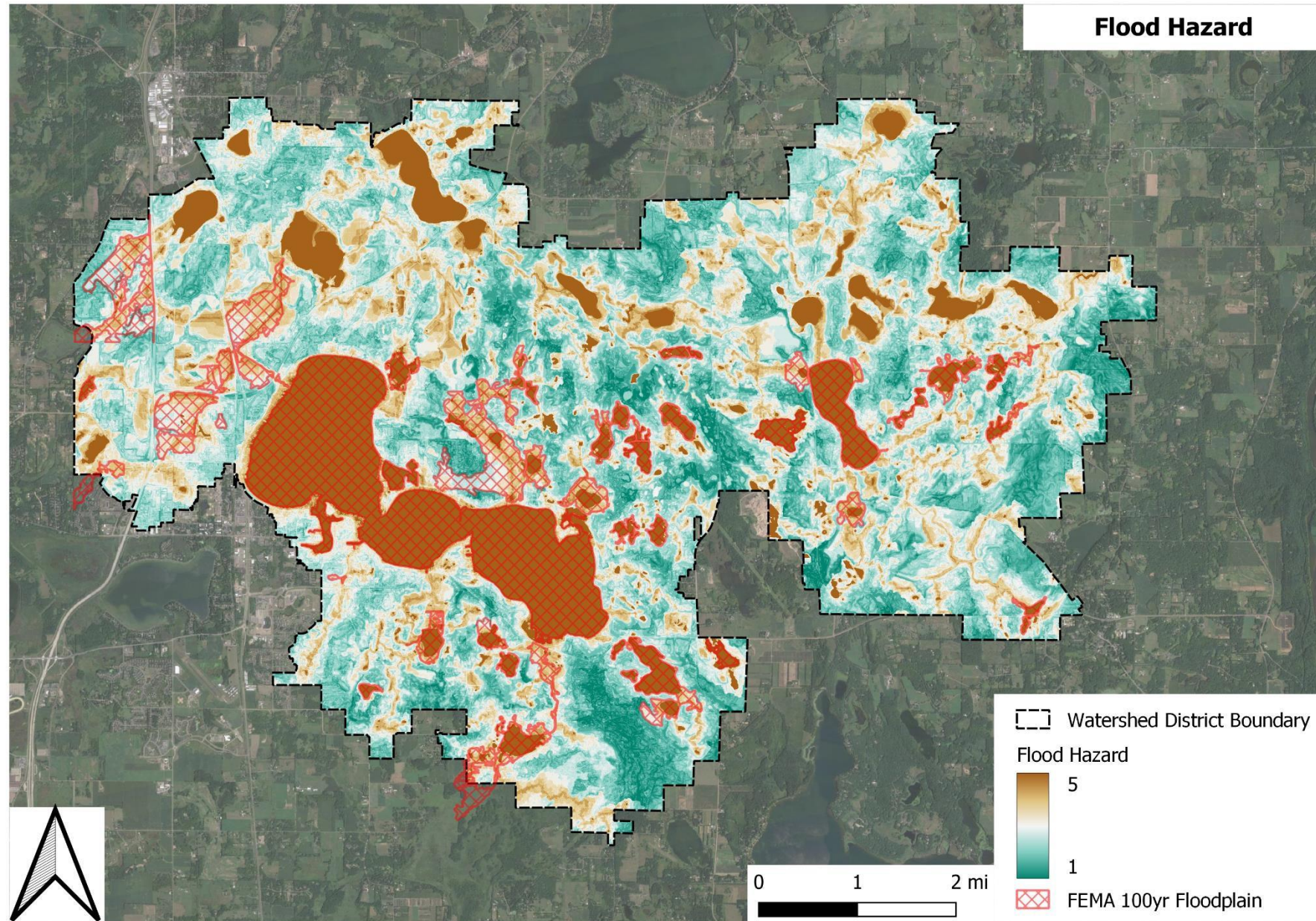
**Distance to Streams
(DS)**



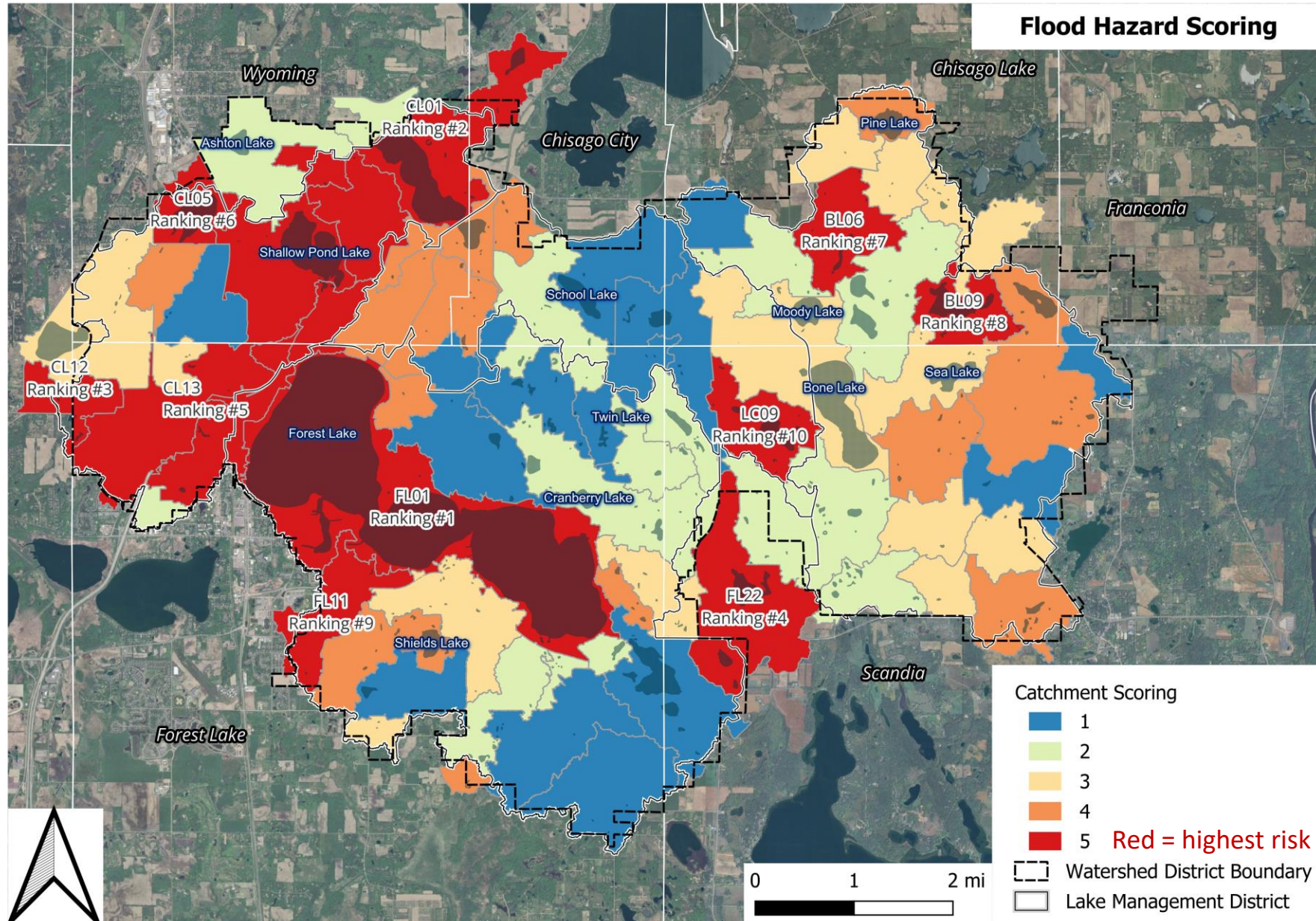
Flood Hazard



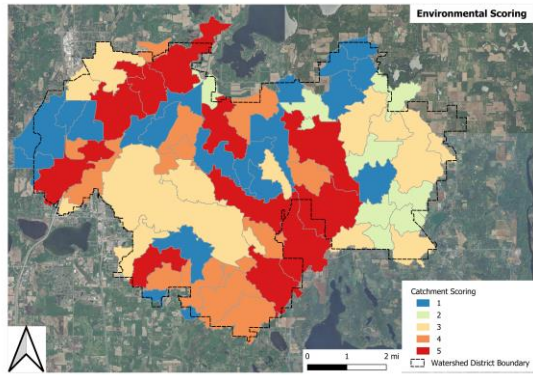
Flood Hazard Scoring



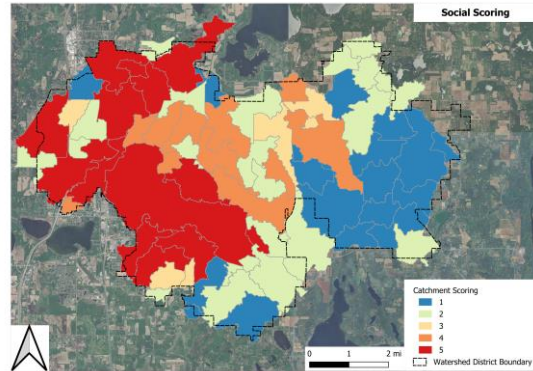
Flood Hazard Scoring



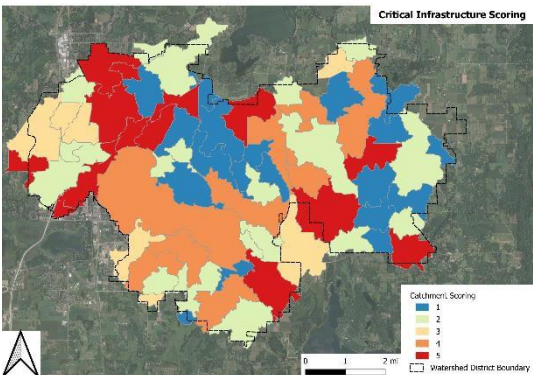
Integrated Scoring (as revised)



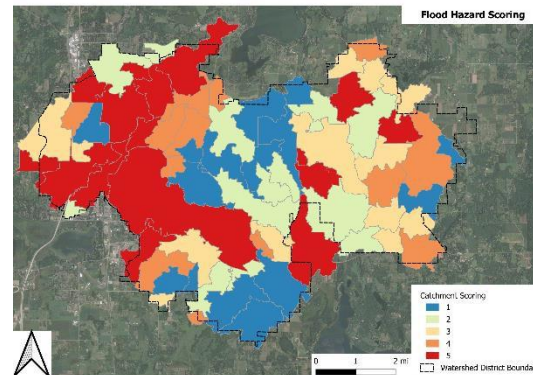
Environmental



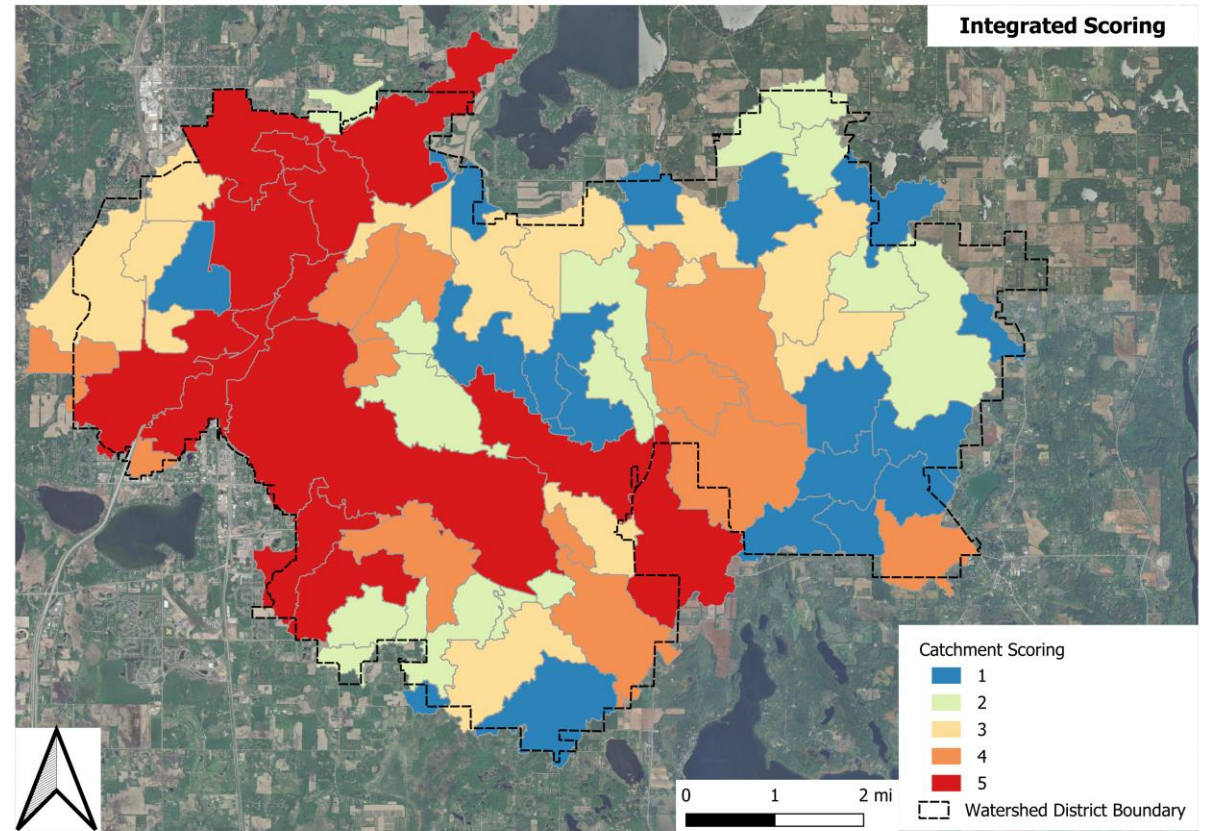
Social



Infrastructural



Flood Hazard



Integrated

Red = highest risk

Integrated Scoring – COMPARISON (*to previous version*)

(# of subcatchments)	Score 5 - Highest Risk		Score 4 - High Risk		Score 3 - Medium Risk		Score 2 - Low Risk		Score 1 - Very Low Risk		Average Score	
	original	revised	original	revised	original	revised	original	revised	original	revised	original	revised
LMD	original	revised	original	revised	original	revised	original	revised	original	revised	original	revised
Comfort Lake	6	7	3	2	4	4	1	1	1	1	4.14	4.22
Little Comfort Lake	0	0	4	3	2	3	3	2	0	1	3.15	3.01
Forest Lake	6	5	3	4	2	2	6	6	5	5	3.73	3.62
Bone Lake	0	0	3	3	6	3	3	5	9	10	2.58	2.38
Total	12	12	13	12	14	12	13	14	15	17	3.41	3.31