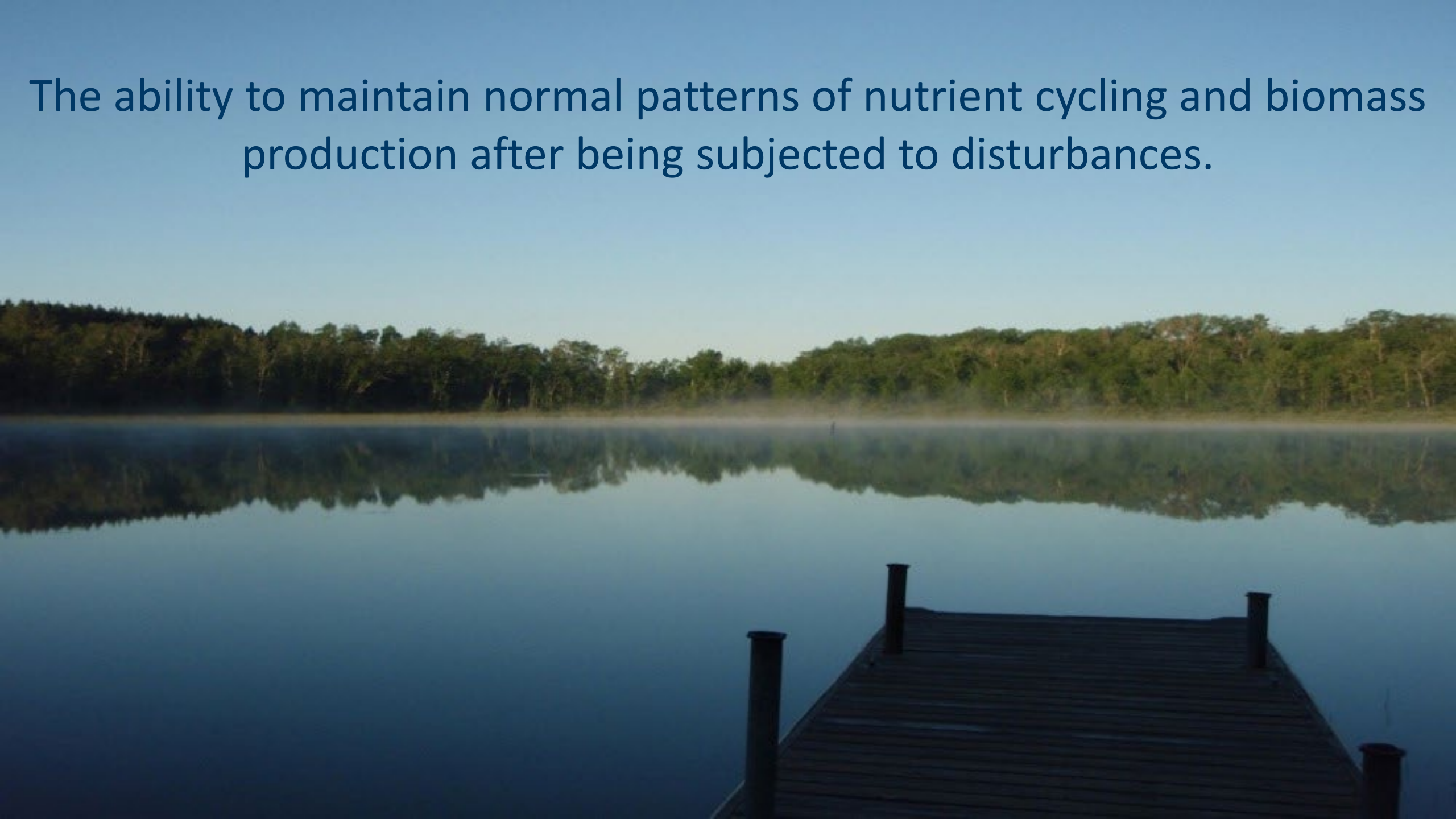
Climate Trends Affecting Lakes & Rivers

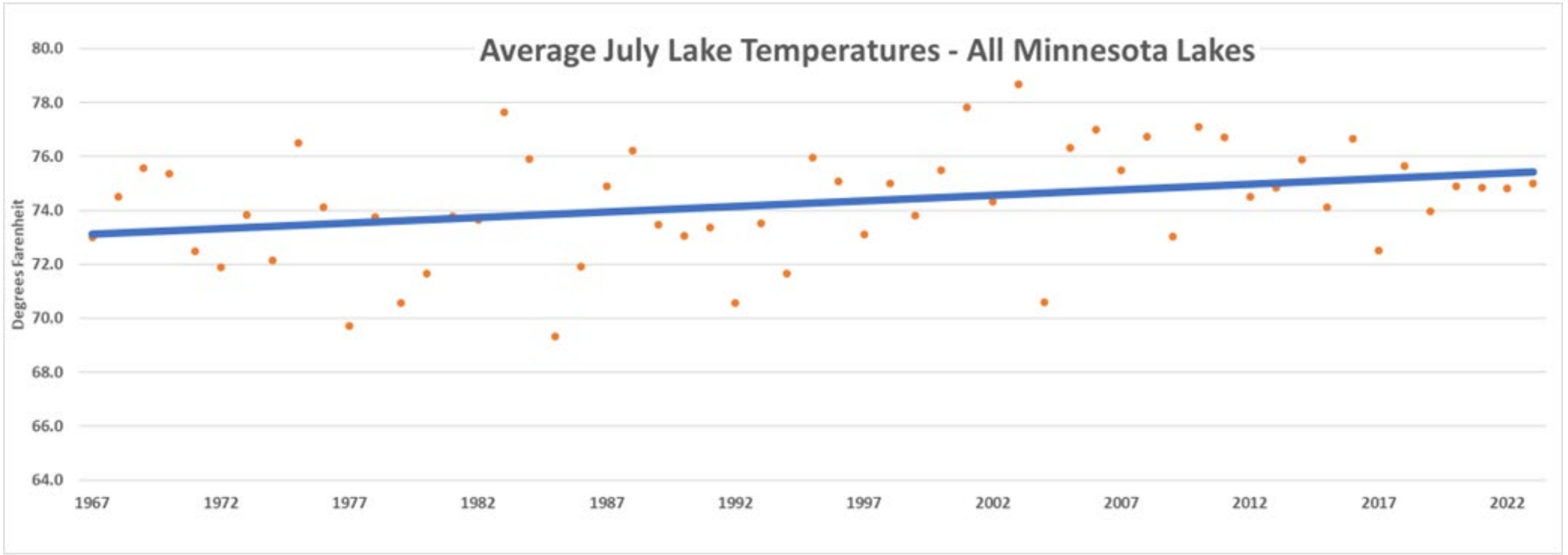
DEPARTMENT OF NATURAL RESOURCES

Dan Petrik, Shoreland Program Manager

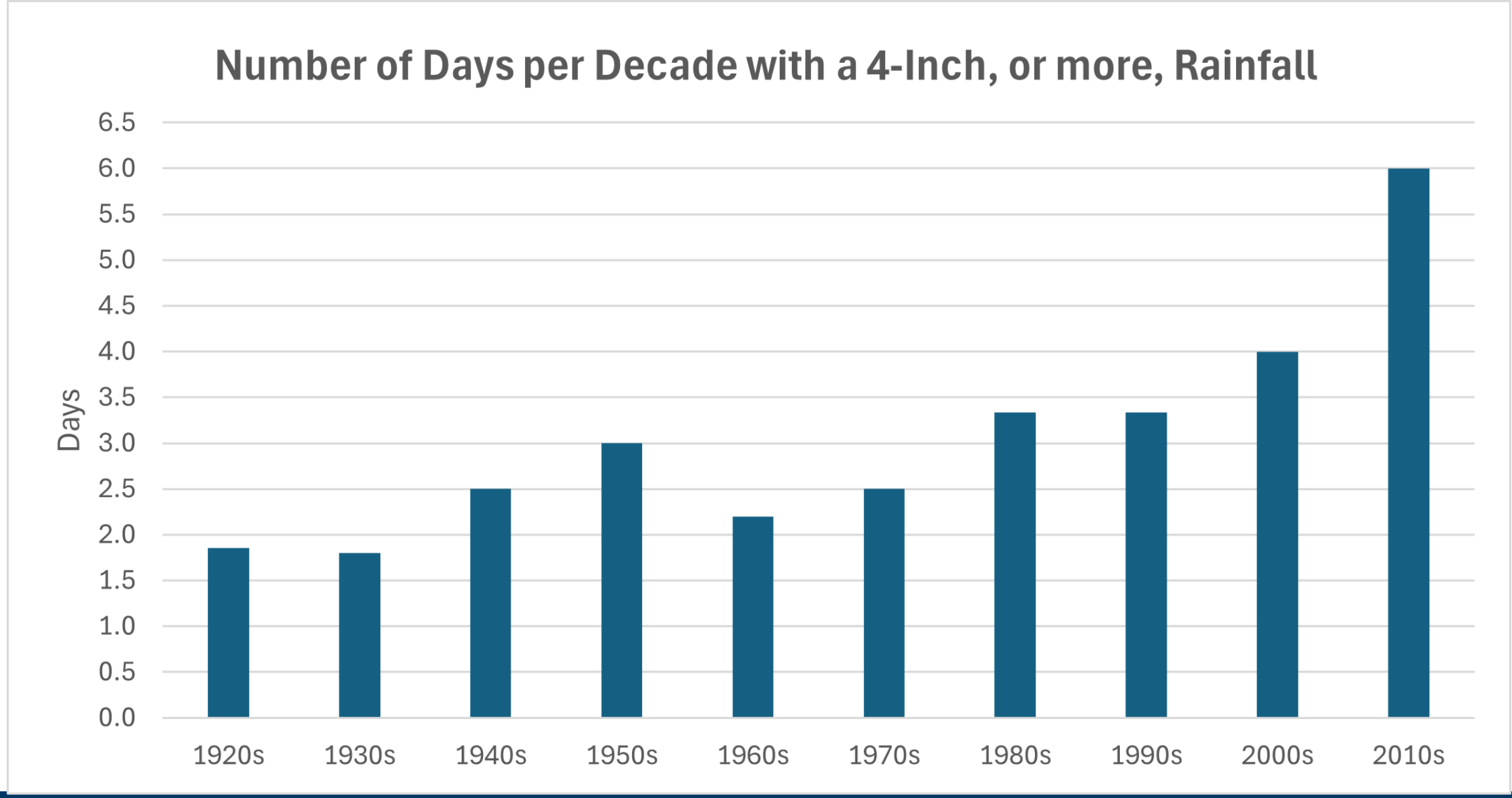
The ability to maintain normal patterns of nutrient cycling and biomass production after being subjected to disturbances.



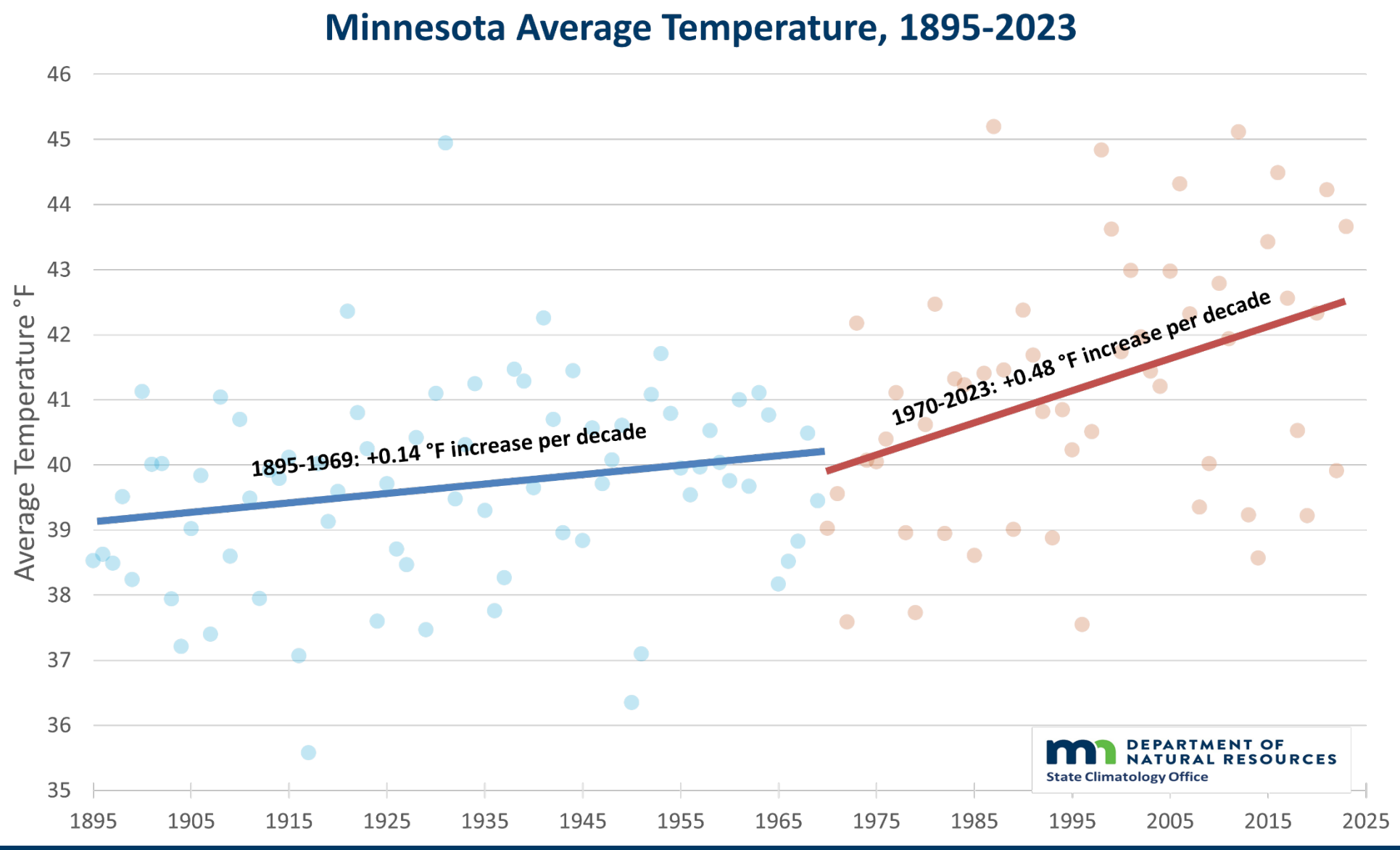
Ecological disturbances: wind, fire, drought, floods, intense rain events, air and water temperature increases



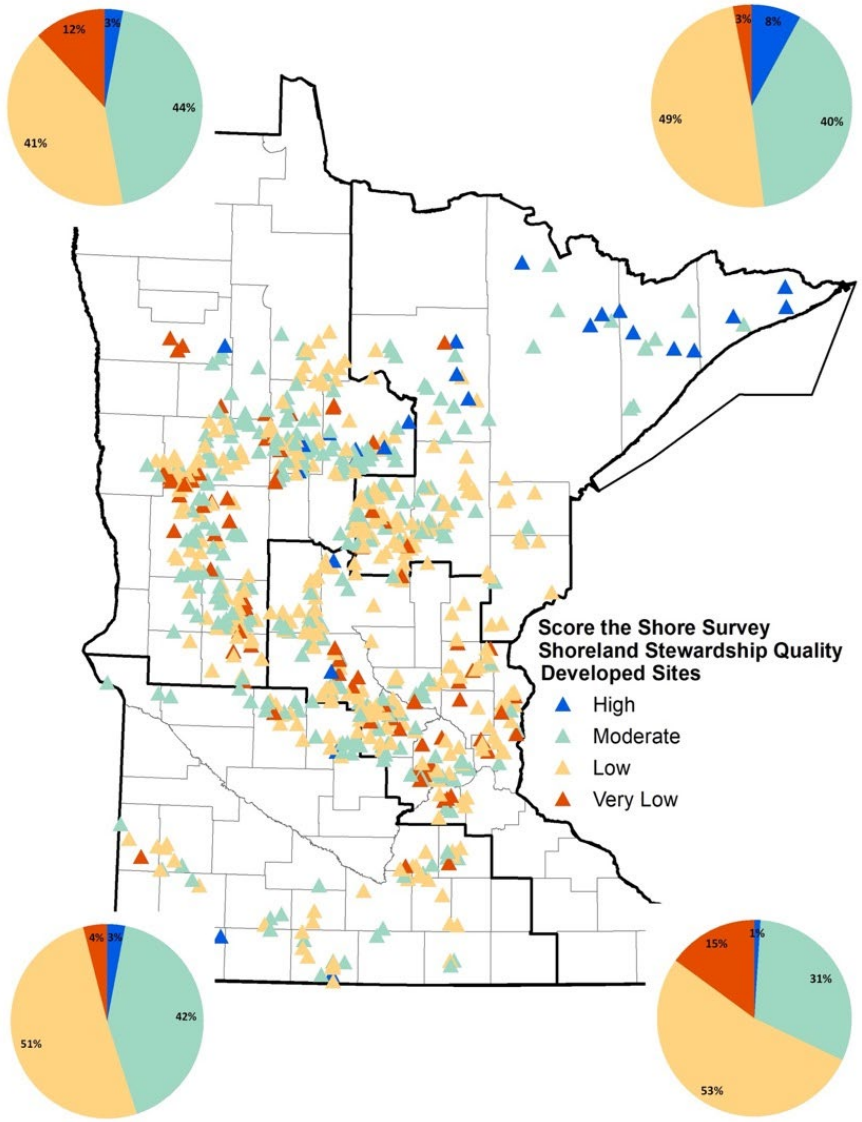
Lakes and Rivers are Getting Warmer



More Frequent & Extreme Rain Events

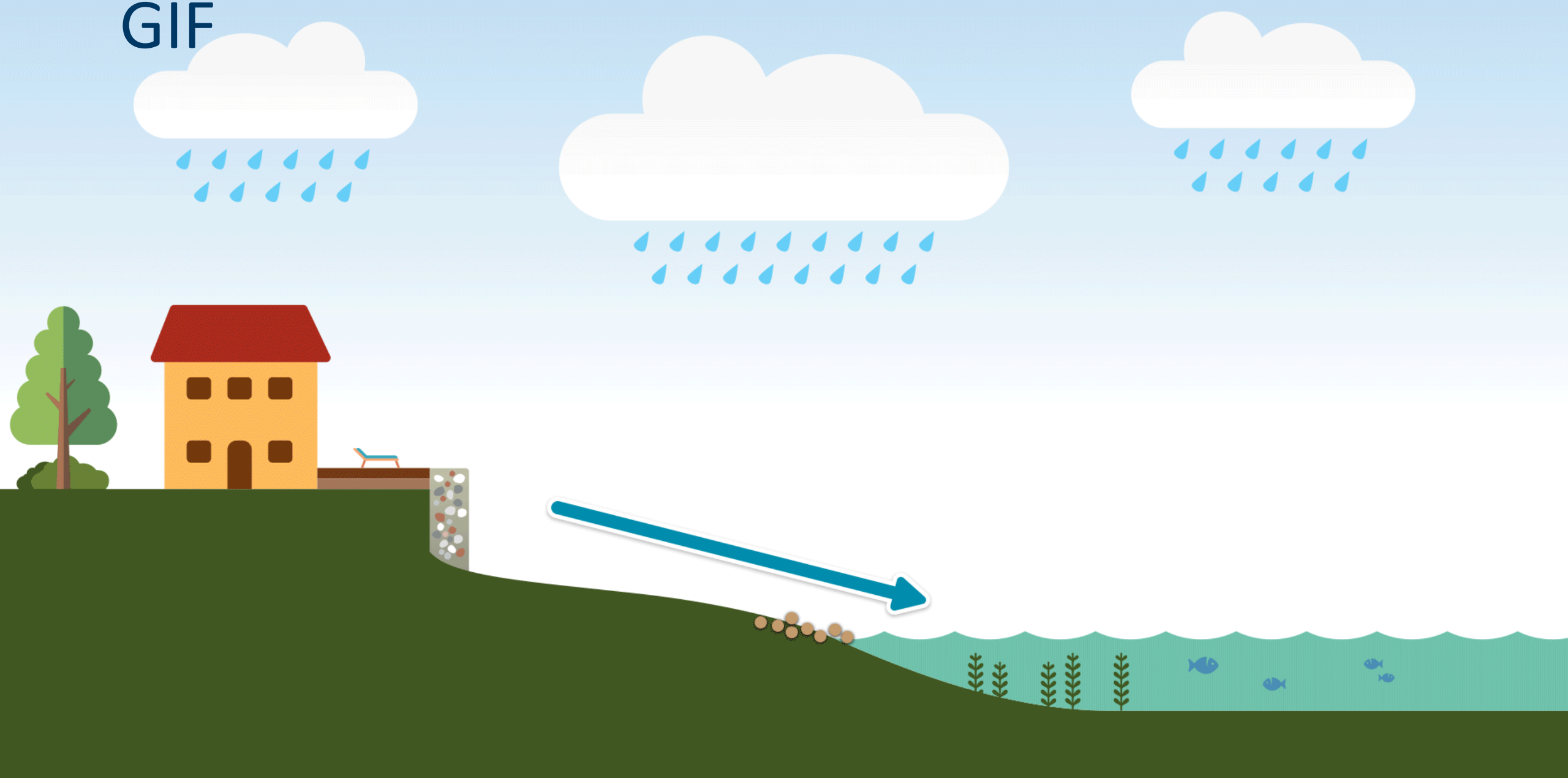


The Rate of Change or Disturbance is Accelerating



We’ve Lost 40-50% of our Natural Shorelines

GIF



GIF2

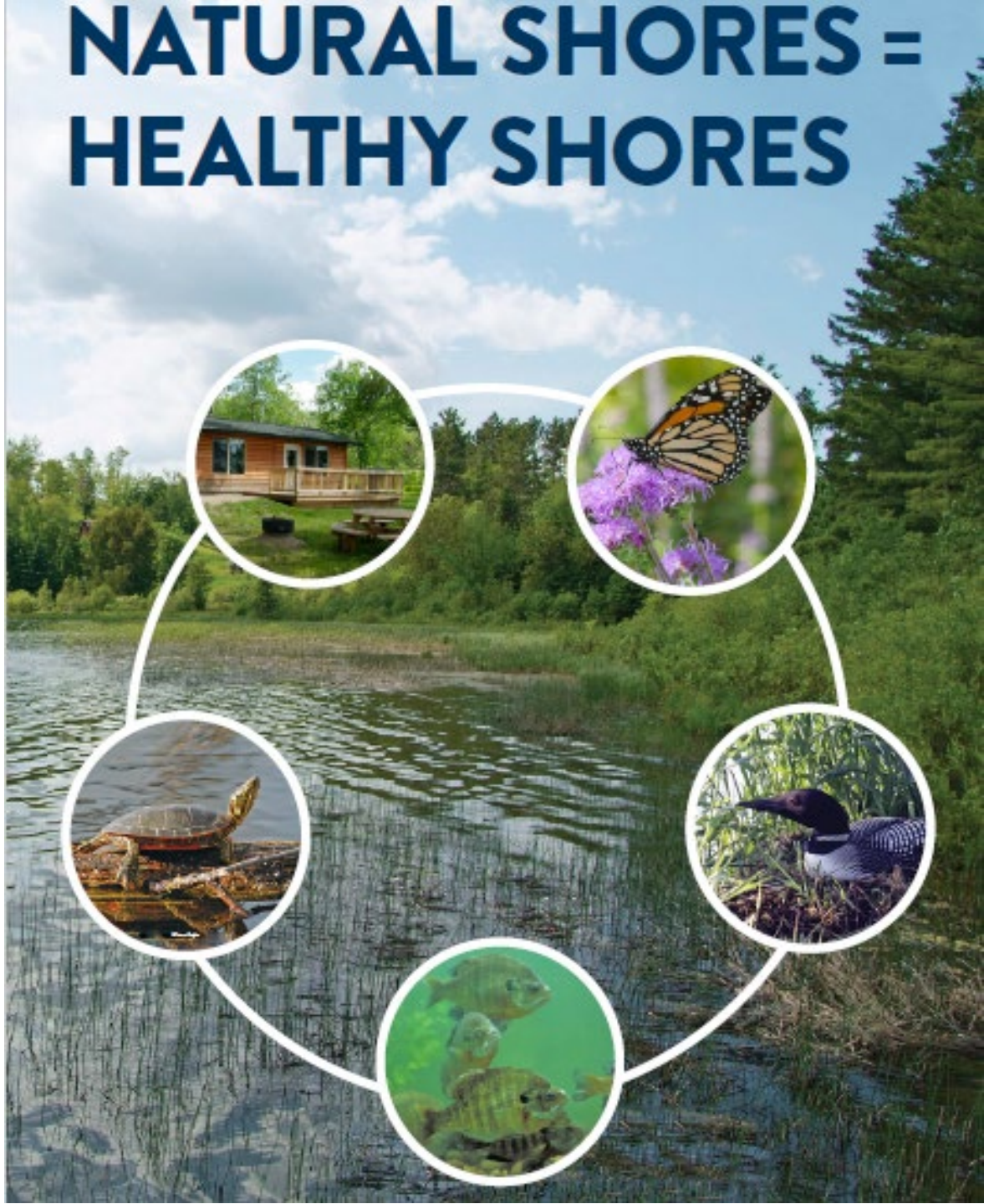
- Loss of nesting habitat is a substantial threat to loons
- Loons prefer vegetated, marshy habitat with good protective cover

Loss of Habitat & Species

Source of Human Resiliency

Natural shorelines are our best defense against climate-related disturbances:

- **Warming waters**
- **Intense rain events**
- **Drought**
- **Floods**



So, how do we protect and restore this important natural Defense when:

- Property owners value suburban-style landscaping
- State shoreland regulations are insufficient
- Silo approach for dealing with water quality and habitat

Local partnerships & collaboration!!

- Local planning and zoning – regulation development & administration
- SWCD – habit, restoration, practical solutions including regulations
- WD/WMO – Water quality expertise
- Lake Associations – local knowledge

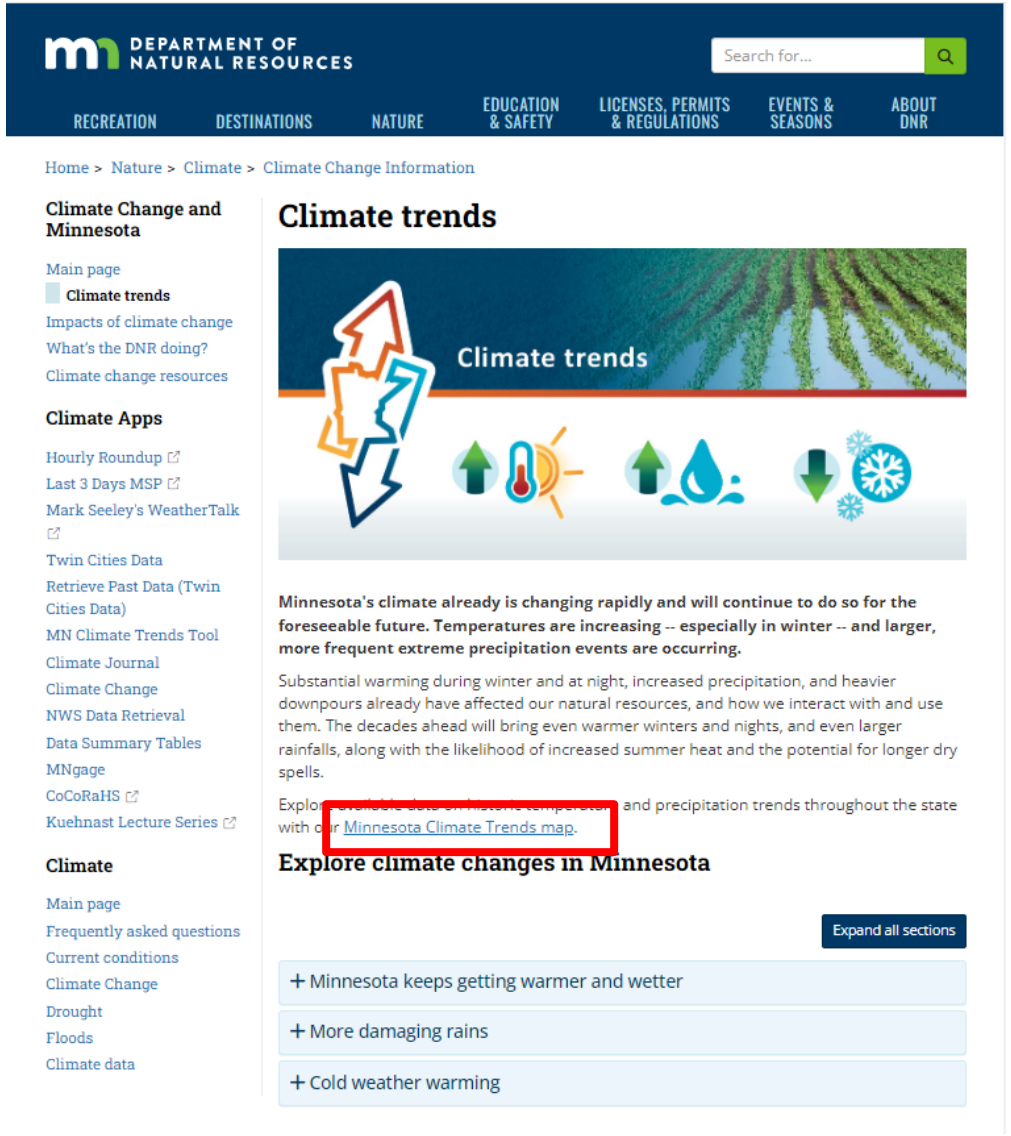
DEPARTMENT OF NATURAL RESOURCES

Hydrological Impacts from Intense Rain Events – Current Regulations & Gaps

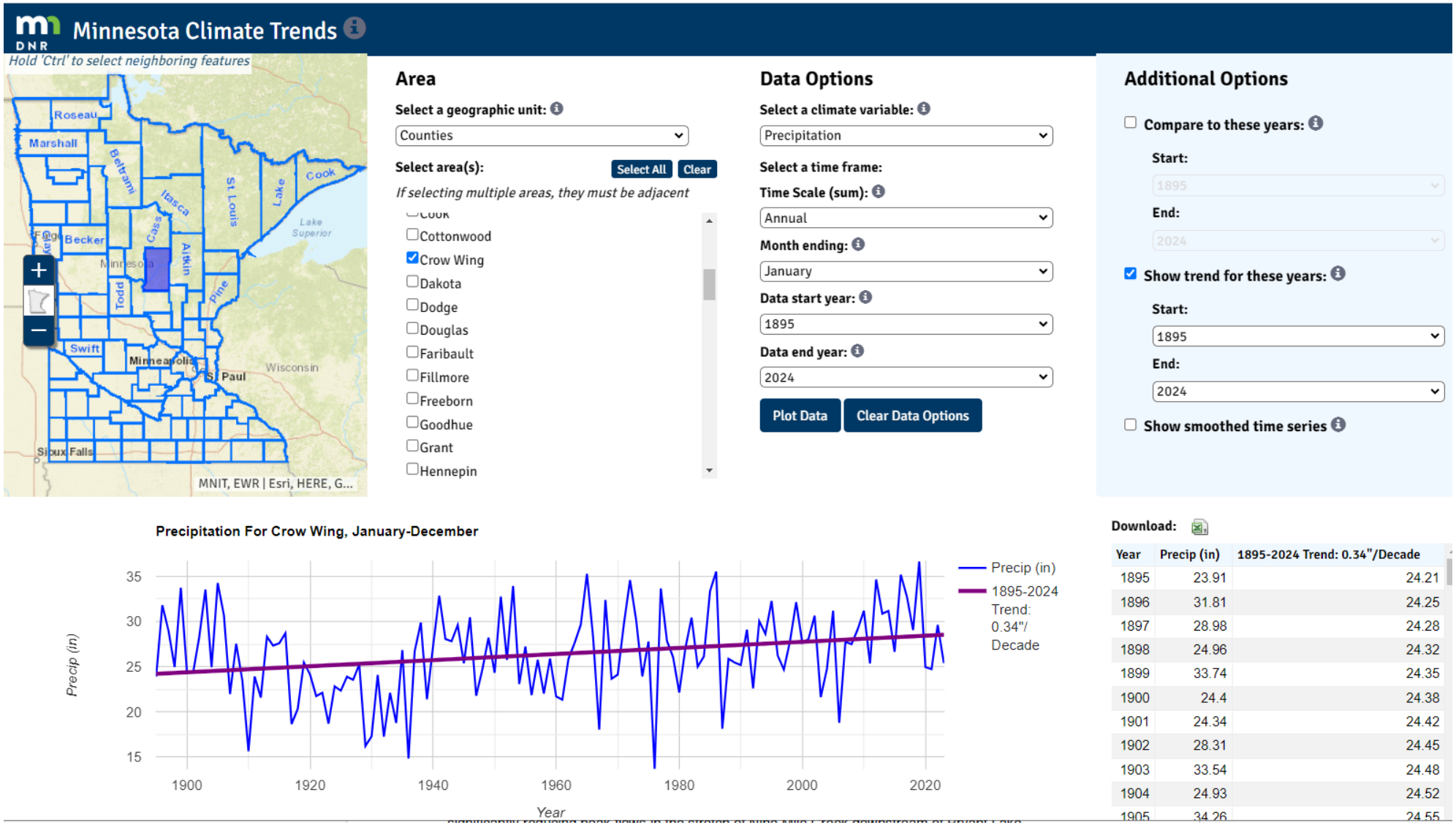
Ceil Strauss, State Floodplain Manager

Climate Change Challenges

- MNDNR Climate trends site
- Includes interactive climate trends map – state or HUC8 level
- Minnesota is getting warmer and wetter, more intense storms
  - ✓8 of 13 “mega rains” since 2000
  - ✓Rain event >3” increased 65% since 2000
  - ✓Widespread rains of more than 6” are 4x more common than previous 3 decades



Minnesota Climate Trends Site



Evaluate:

- Temperature
- Precipitation

Evaluate by:

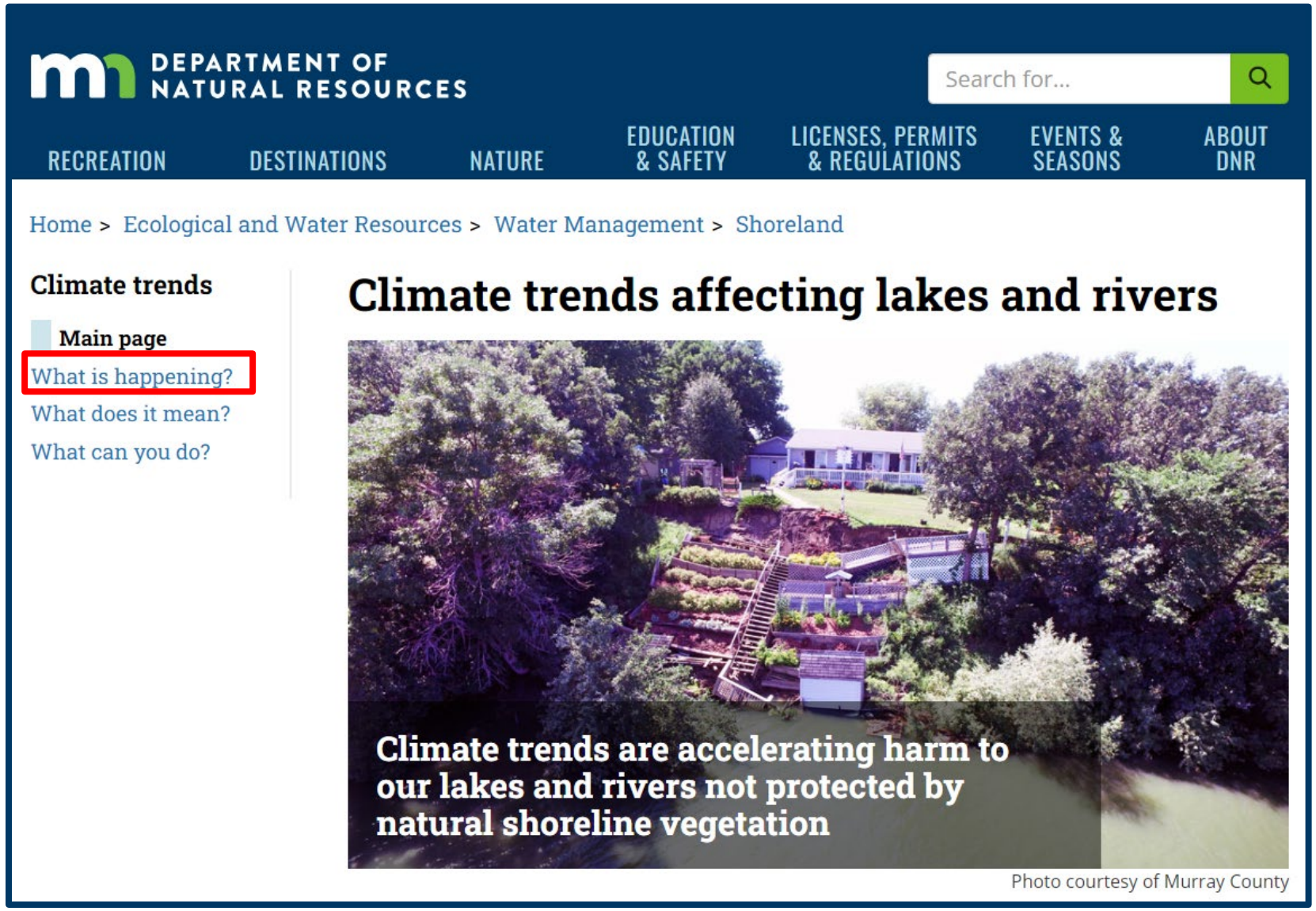
- County
- Major watershed
- Deer permit areas
- State forests or parks
- Whole state

Other Risks

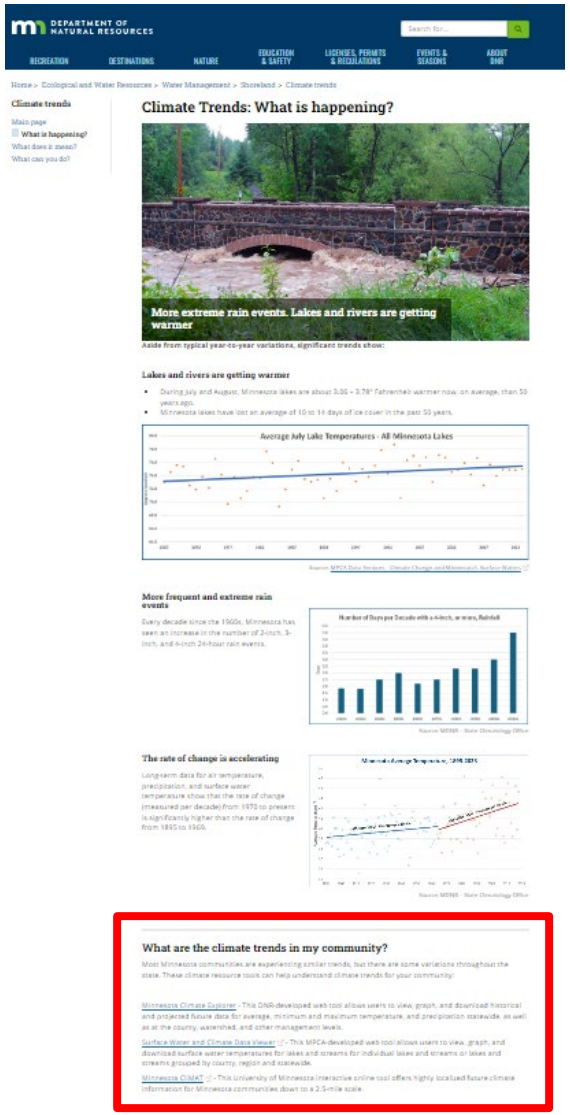
- Storms during more of the year – Rain (!) in late December and January (also, ice jams & related risk in more areas and times of year)
- Shorter ice cover periods
- Longer periods of high water - Mississippi above flood stage 42 days in St. Paul (2019)
- Groundwater/high water tables
- Landslides & stream bank erosion
- Pluvial (e.g., urban flooding)
- Other unmapped: not mapped since not development pressure in 1970s/1980s (when current maps done), but now there's development; old stormwater systems

Climate Trends Outreach

- September 2024: New Climate trends affecting lakes and river webpage
- See September 2024 Water Talk article about new site



Climate Trends: What is happening?



What are the climate trends in my community?

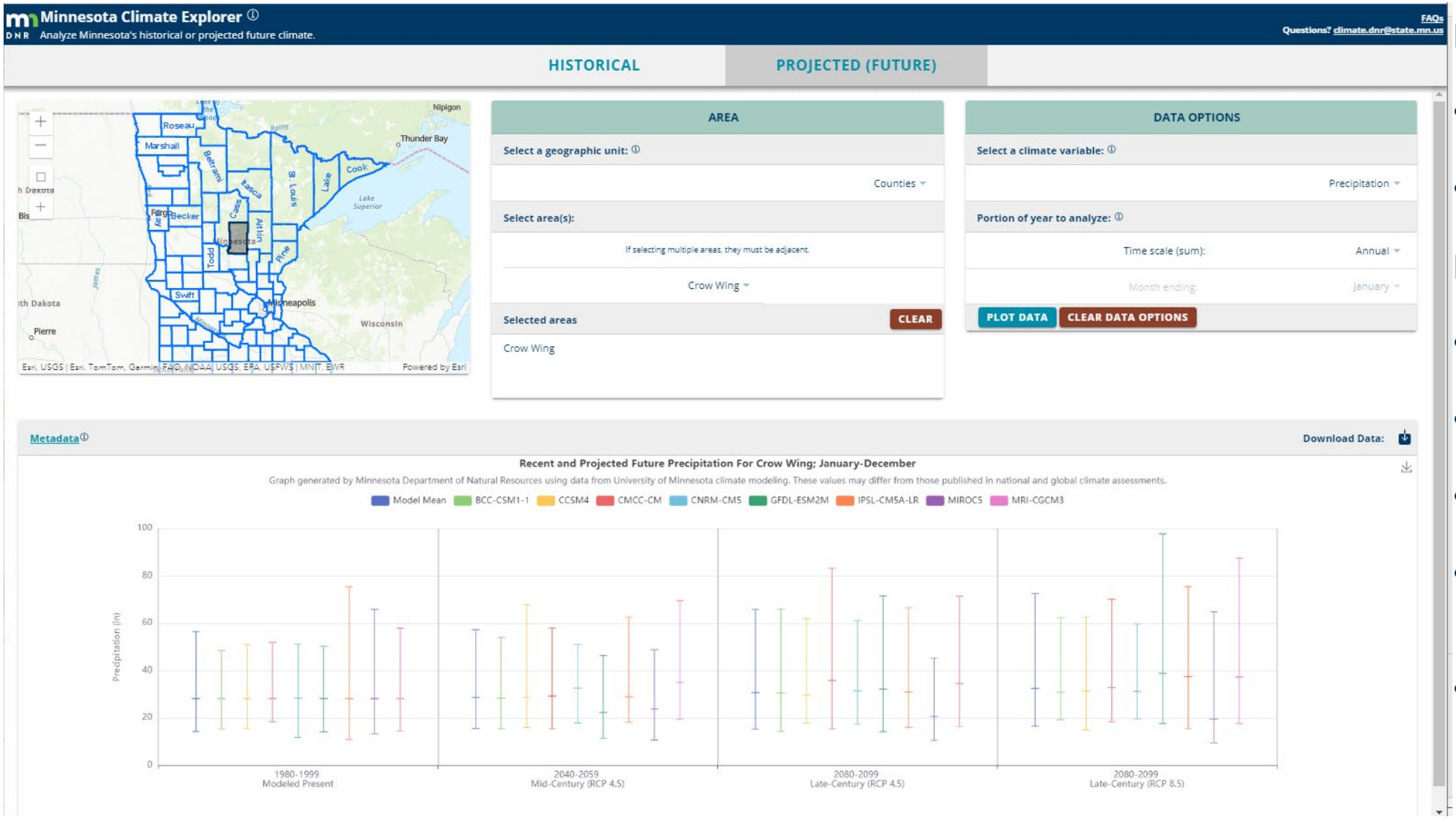
Most Minnesota communities are experiencing similar trends, but there are some variations throughout the state. These climate resource tools can help understand climate trends for your community:

Minnesota Climate Explorer - This DNR-developed web tool allows users to view, graph, and download historical and projected future data for average, minimum and maximum temperature, and precipitation statewide, as well as at the county, watershed, and other management levels.

Surface Water and Climate Data Viewer - This MPCA-developed web tool allows users to view, graph, and download surface water temperatures for lakes and streams for individual lakes and streams or lakes and streams grouped by county, region and statewide.

Minnesota CliMAT - This University of Minnesota interactive online tool offers highly localized future climate information for Minnesota communities down to a 2.5-mile scale.

Minnesota Climate Explorer Site – Includes Projected (Future) Options



Evaluate:

- Temperature
- Precipitation

Evaluate by:

- County
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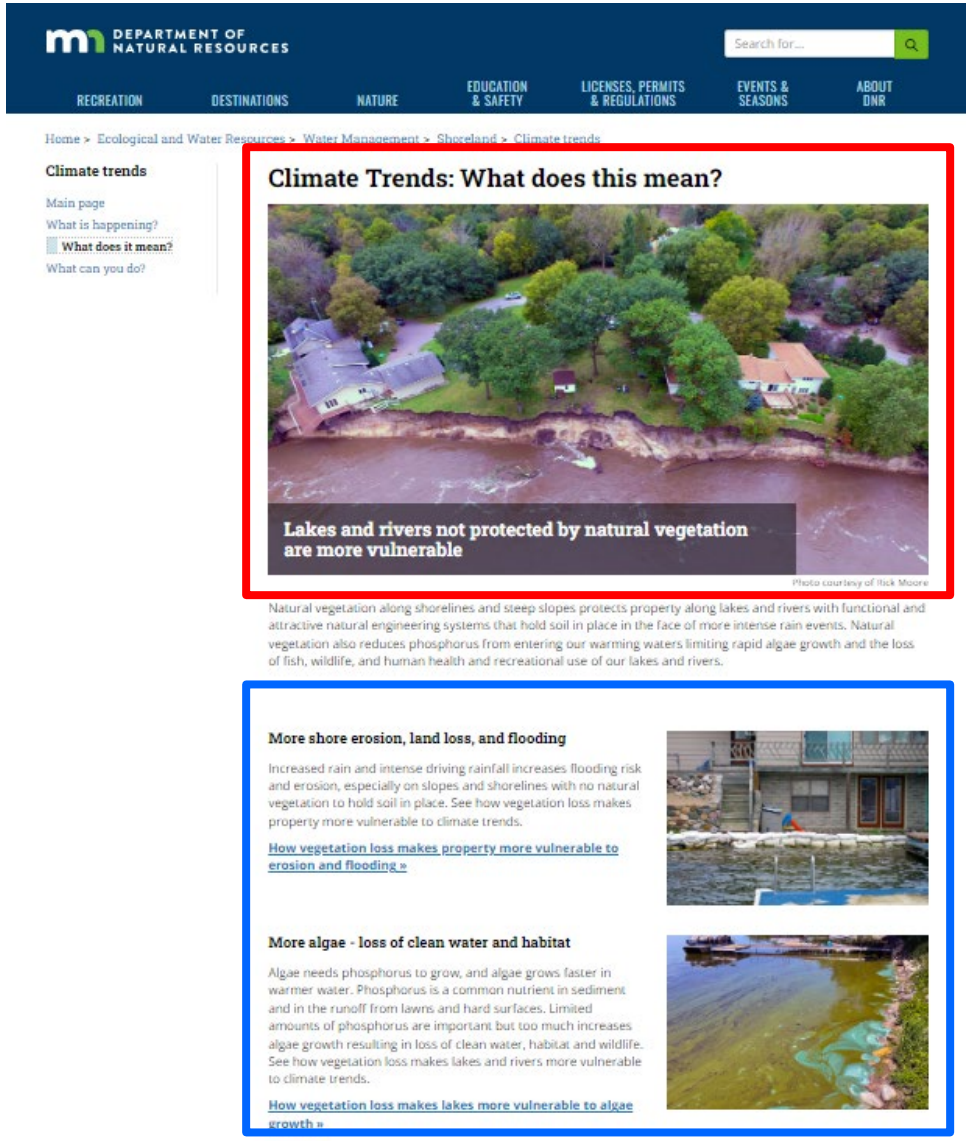
- State forests or parks
- Whole state

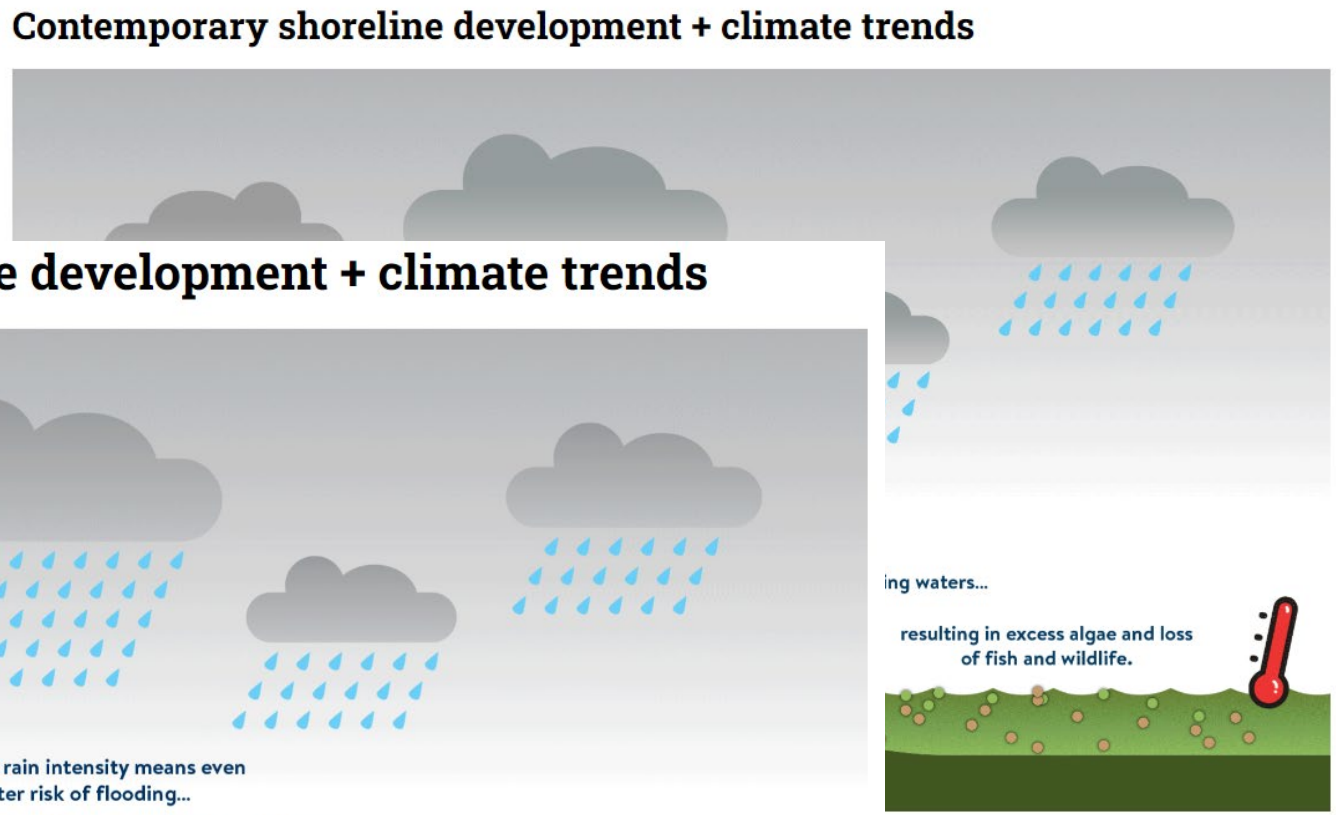
Climate Trends: What does this mean?



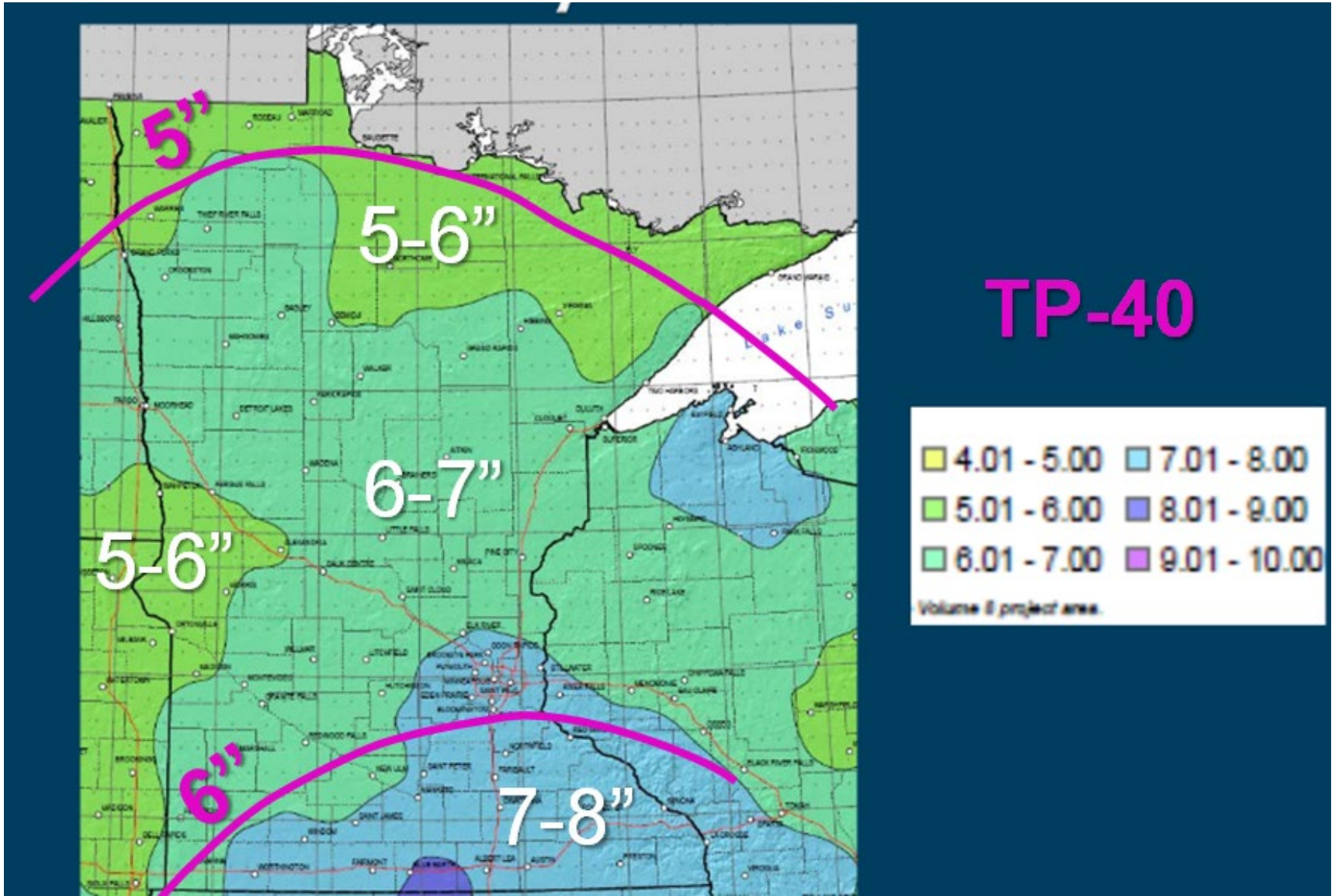
Climate Trends Webpage

In “What does it mean?” section, animations help tell the story

- Water quality webpage
- Shore erosion/flooding webpage

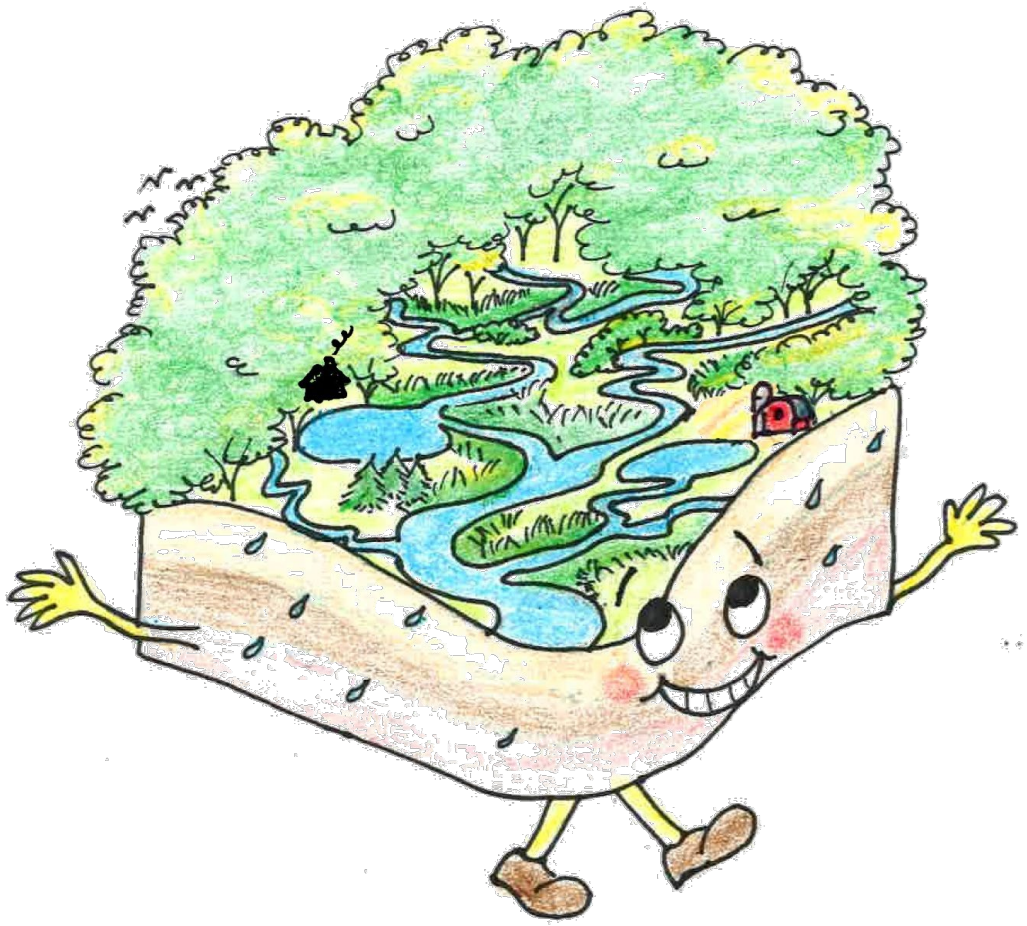


Technical Paper 40 (1960) versus Atlas 14 (2013) versus Future Trends



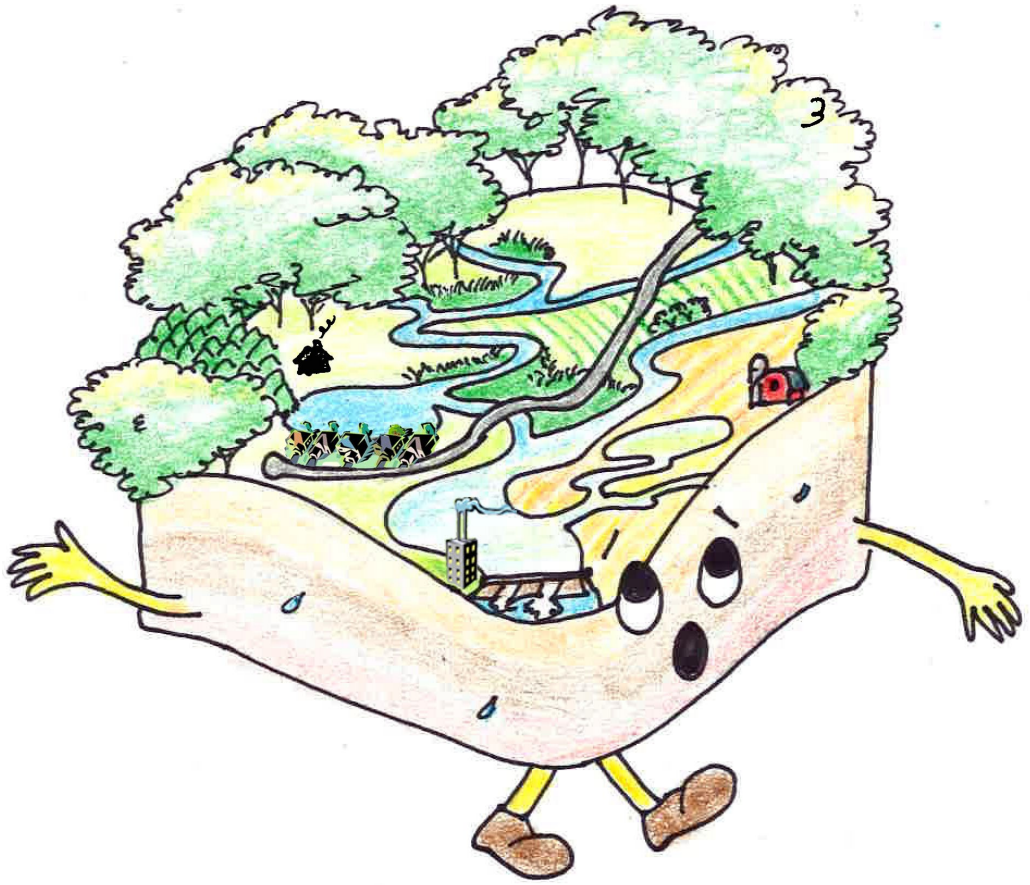
- Older maps based on TP 40 versus Atlas 14 (or other more up to date methods, e.g. gages, regression equations)
- Atlas 14 is based on updated historical records (no future projections)
- New Atlas 15 just coming out – includes future trends

Meet Walter Watershed!
Walter was a healthy watershed.



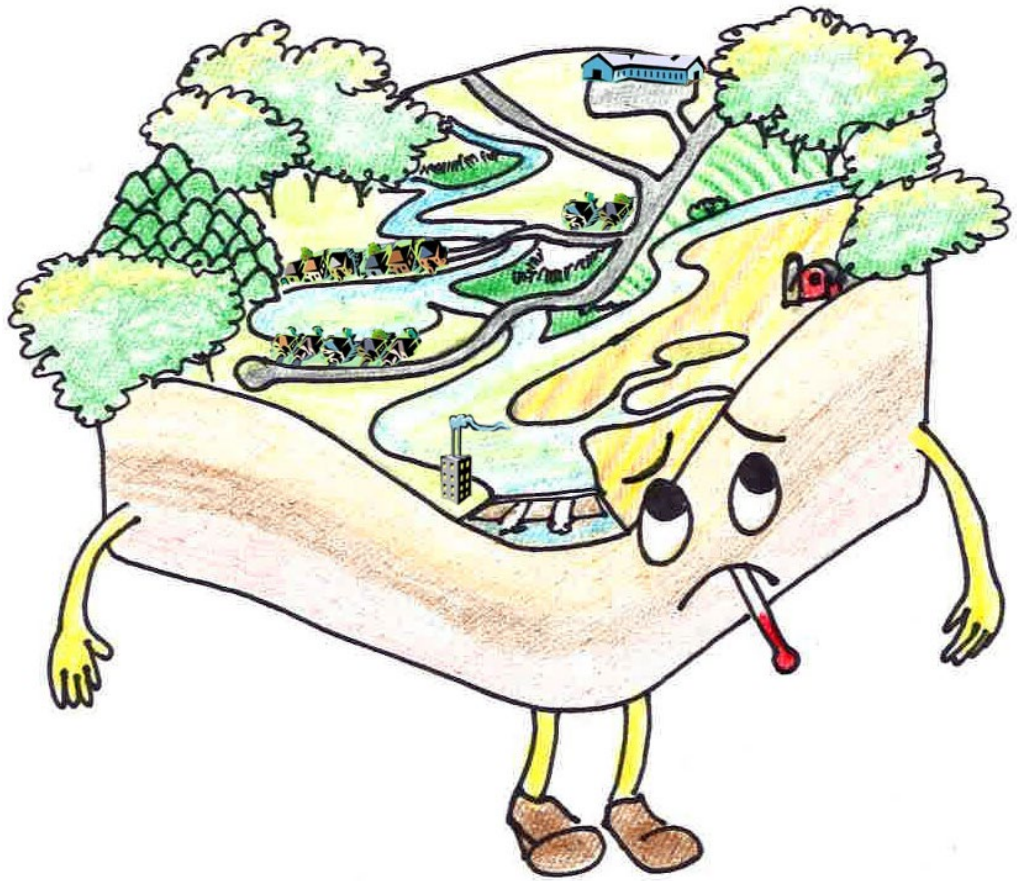
- Free flowing streams & rivers
- Diverse plants & animals
- Clean water
- Stable stream banks & soils
- Good infiltration & storage

Over time, Walter began noticing some changes…



- Interrupted flow & diversions
- Receding tree line
- Chemicals & sediments in water
- Eroding stream banks & soil loss
- Clogged pores & less infiltration

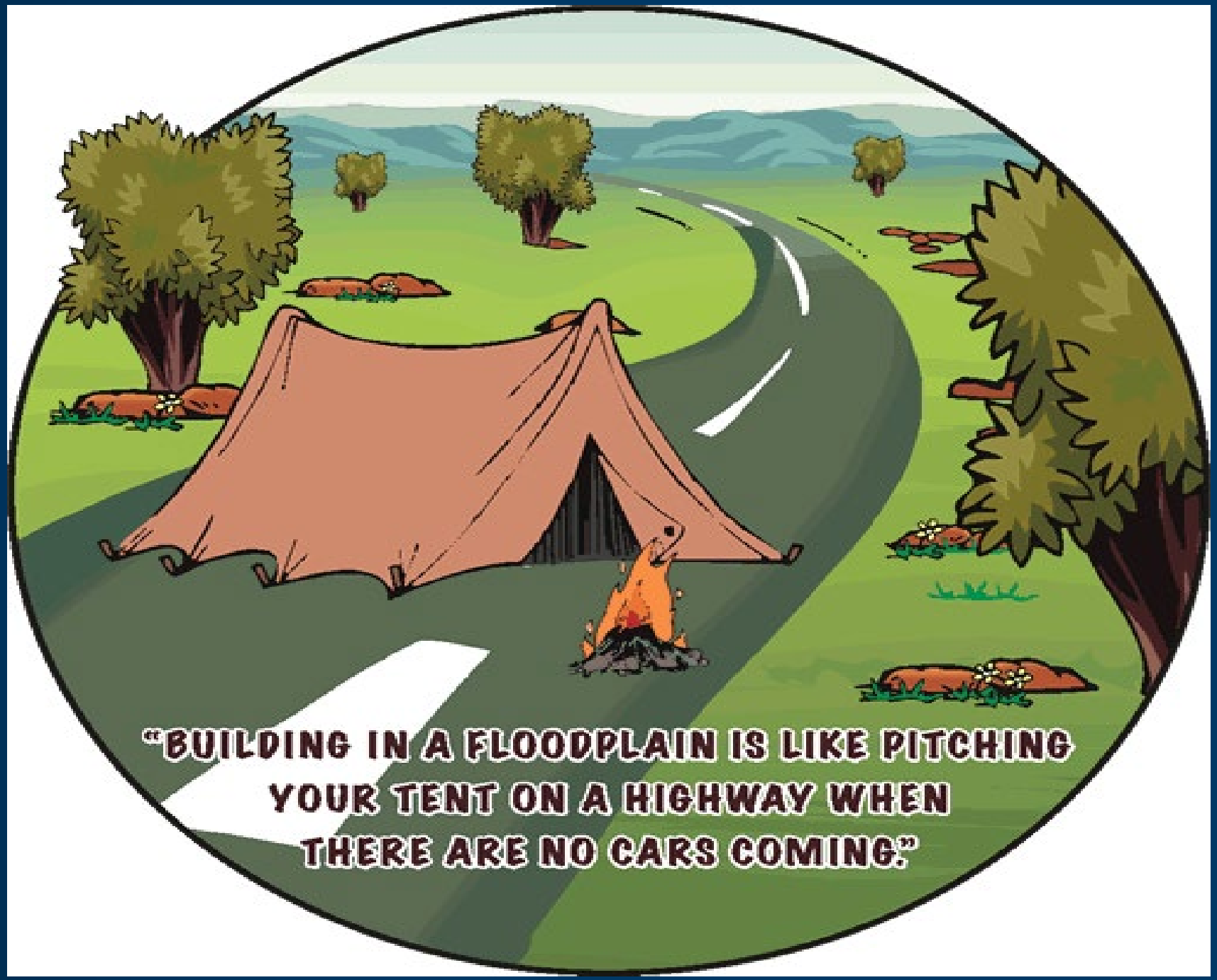
Today, Walter isn’t feeling so hot. How can we help Walter?



- Disconnected & blocked waterways
- Unwanted vegetation loss
- Brown water & algae blooms
- Undercut banks & severe erosion
- Poor drainage & infiltration

Overall Impacts We Want to Reduce/Prevent

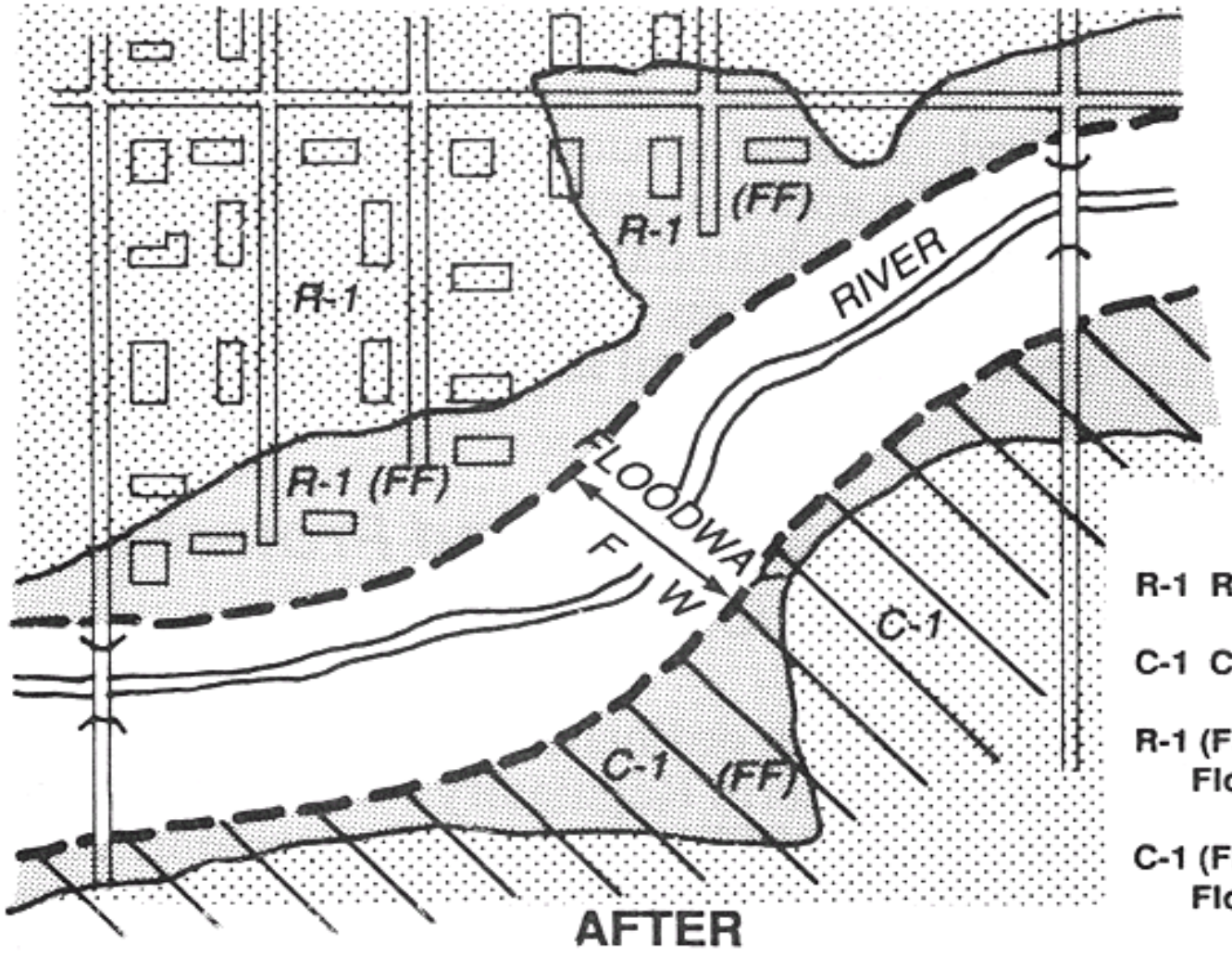
- More runoff
  - ✓ Retain/restore/add natural vegetation
  - ✓ Retain/restore/add storage areas
  - ✓ Reduce impervious surfaces
- Eroded banks/shorelines
  - ✓ Reduce runoff quantity
  - ✓ Reduce runoff peaks
  - ✓ Retain/restore natural vegetation
- Higher water levels
  - ✓ Keep new construction out of floodprone areas and setback from banks/shorelines
  - ✓ Elevate any new construction/reconstruction/additions that are allowed



Very Basics for Floodplain Zoning Requirements

Source: Rob Pudim

Top View of Floodway vs Flood Fringe



FLOOD FRINGE

FLOODWAY

FLOOD FRINGE

R-1 Residential

C-1 Commercial

R-1 (FF) Residential Flood Fringe

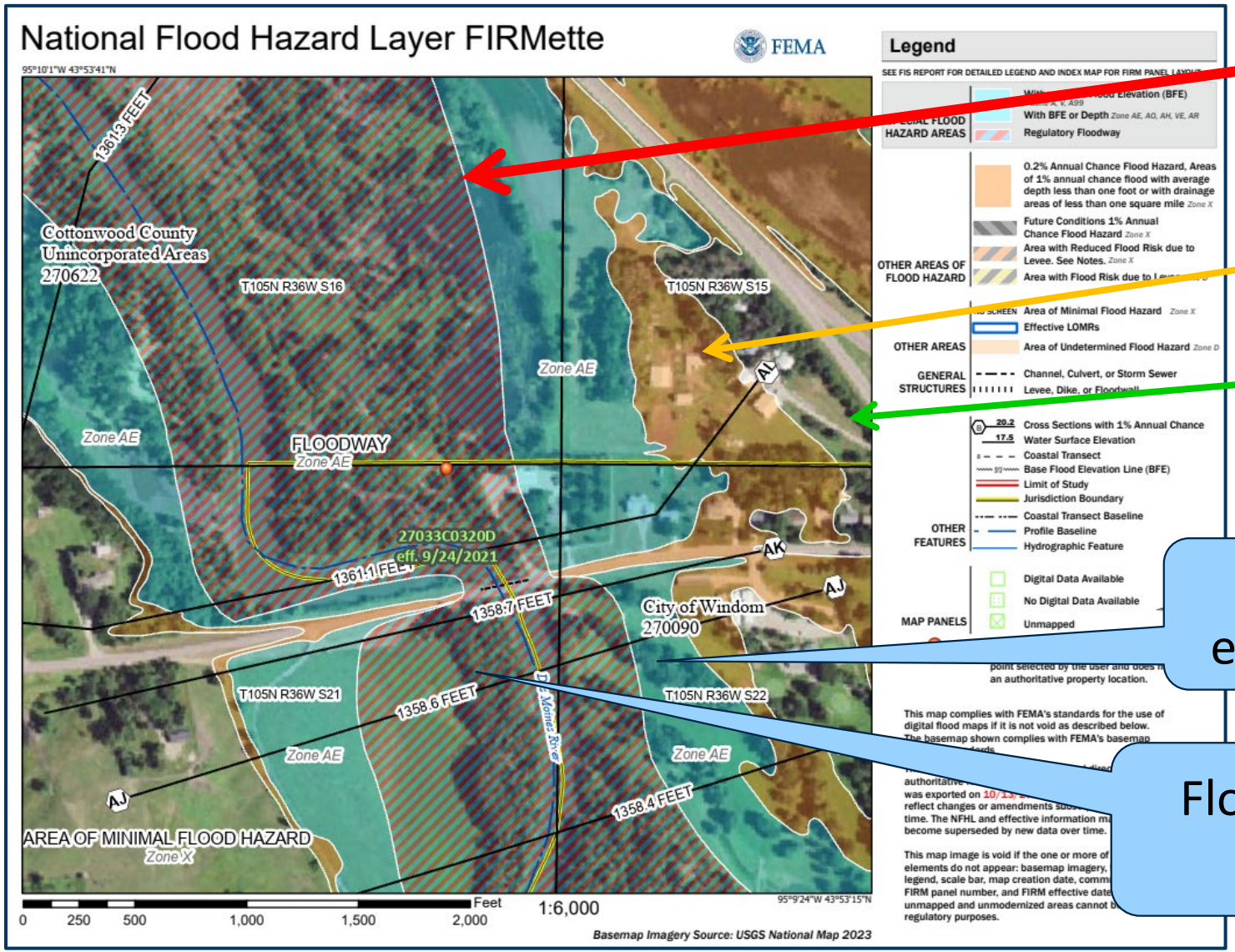
C-1 (FF) Commercial Flood Fringe

FW Floodway

Very restrictive in floodway:

- No new buildings
- No expansion so existing buildings
- Hydraulic analysis for any grading/filling

FEMA Map with Special Flood Hazard Area (SFHA)



High Flood Risk (must require flood insurance and regulate)

Medium Flood Risk

Low Flood Risk

Flood Fringe (blue overlay) – elevation/flood proofing standards

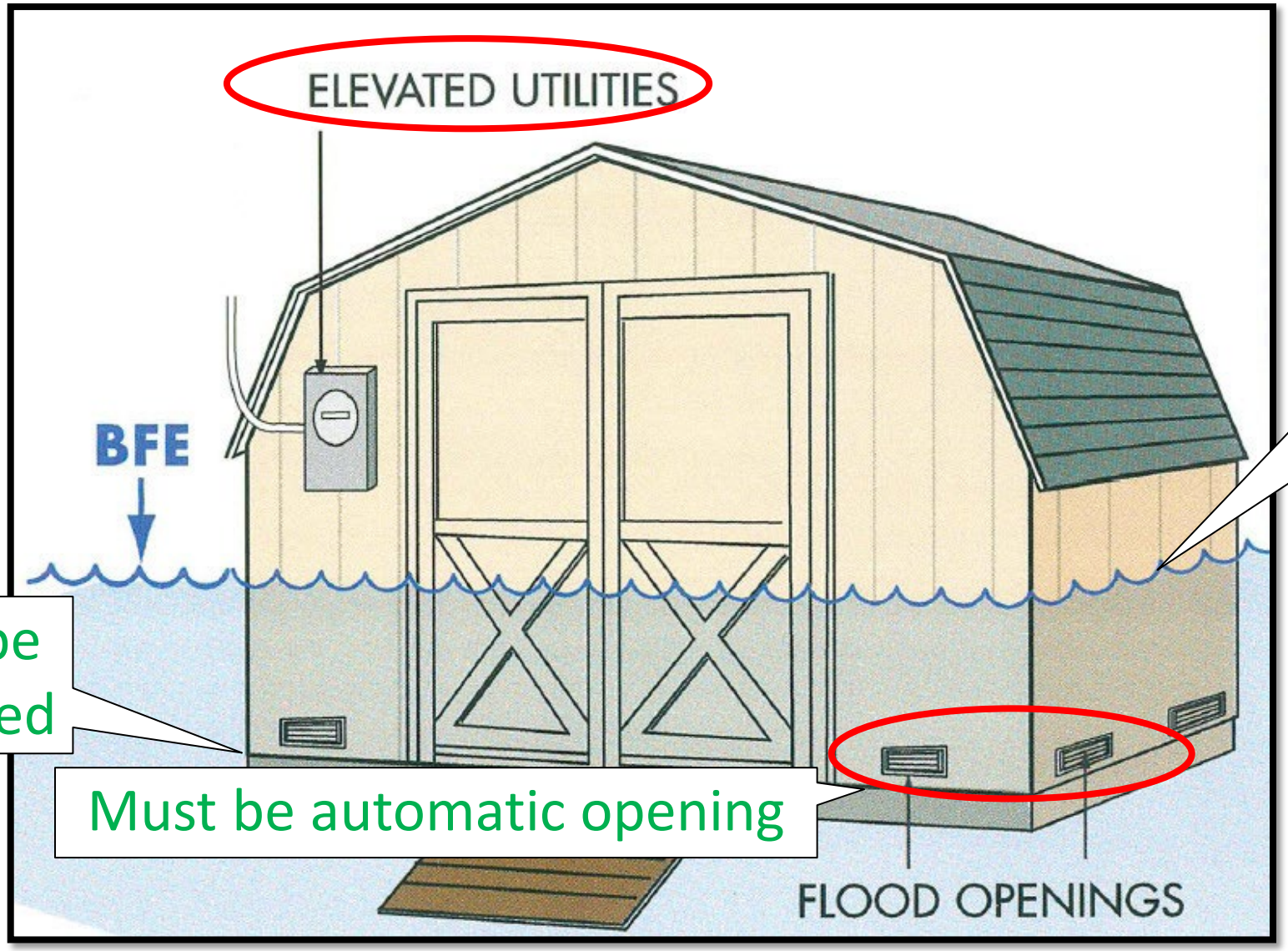
Floodway (red & blue hatched area) – very restrictive zoning

Minimum Elevation Requirements in Flood Fringe

- Structures elevated on fill
- Structures can be elevated on pilings, piers, or perimeter walls (for residential, a CUP is required)*

* In older versions of DNR's state model floodplain ordinance, a CUP is required for non-residential also.

Accessory Structures less than 576 SF & Used only For Parking and/or Storage

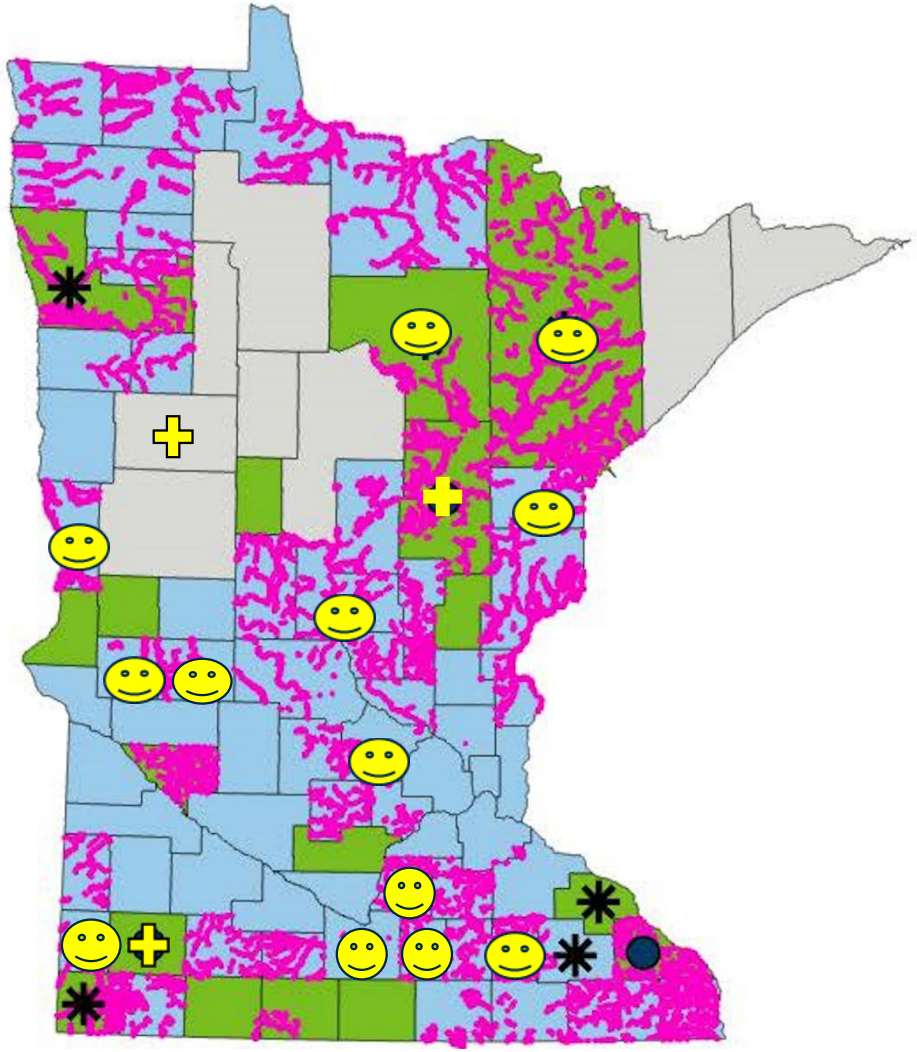


Flood resistant material up to RFPE

Must be anchored

Must be automatic opening

Mapping Updates
Flood Insurance Rate Maps (FIRMs)



lates of this map on DNR's [Find Flood Maps page]

New DFIRM in Dec. 2023 to March 2025

DFIRM Counties

Paper Map Counties

Unmapped Counties

Estimated 1% Base Flood Elevations

Preliminary DFIRMs Available

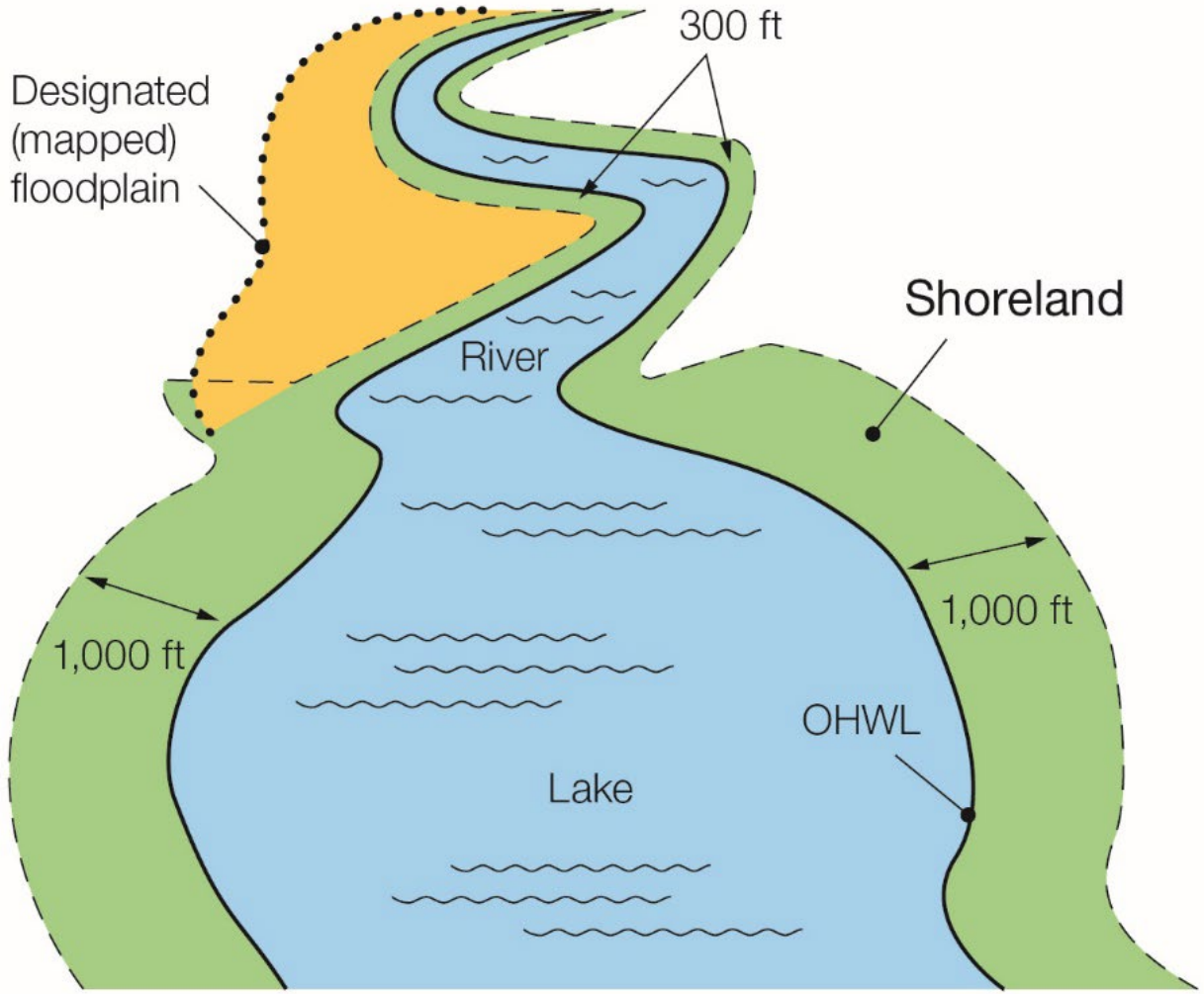
Countywide Modernization

Funded through Preliminary New Maps

Within Shoreland Districts (also adopted in 1969)
Also Have Minimum Lowest Floor Requirements

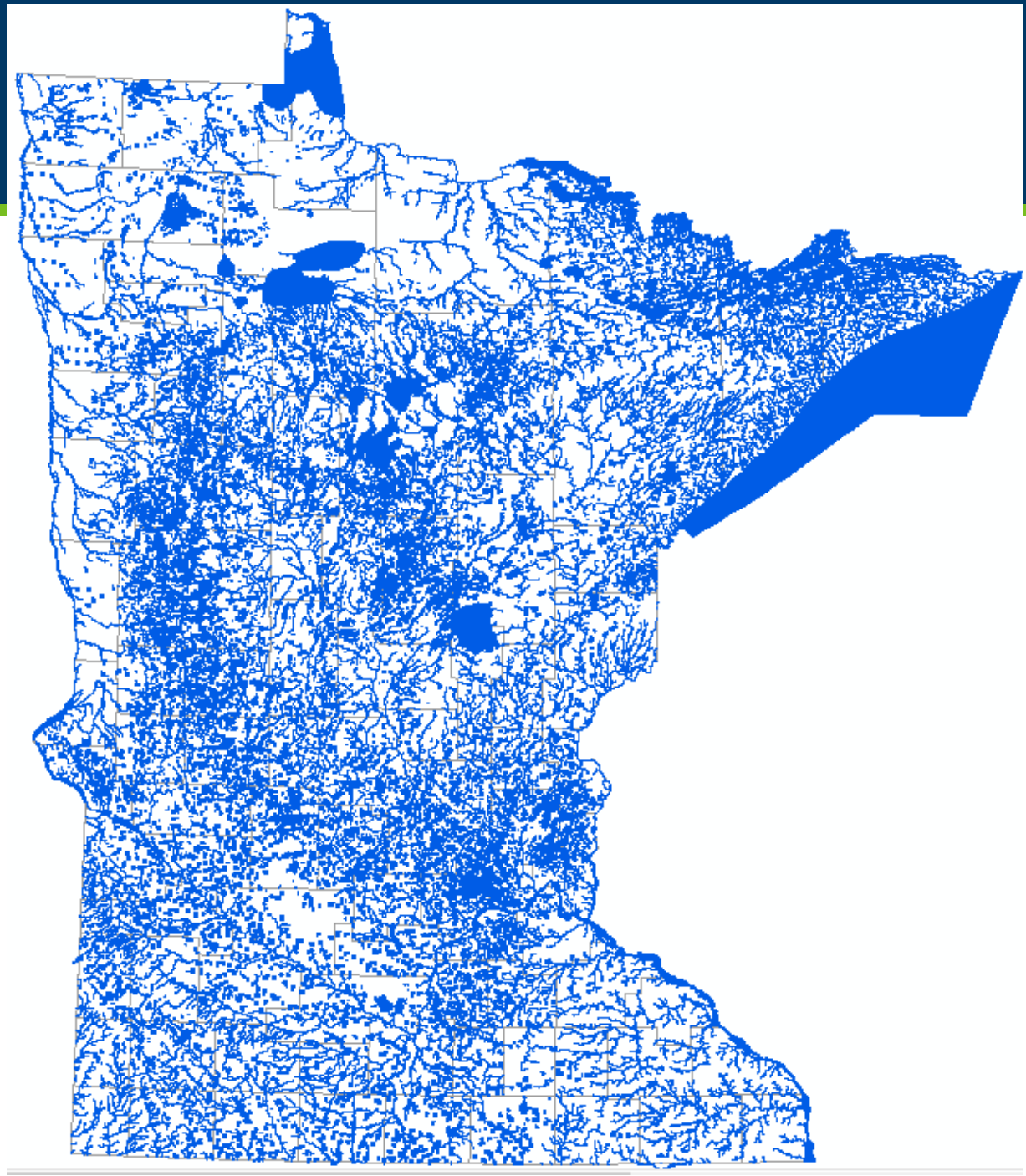
- 1000 feet from OHWL for lakes
- 300 feet from OHWL for rivers/streams or floodplain boundary, whichever is greater

Boundaries of District



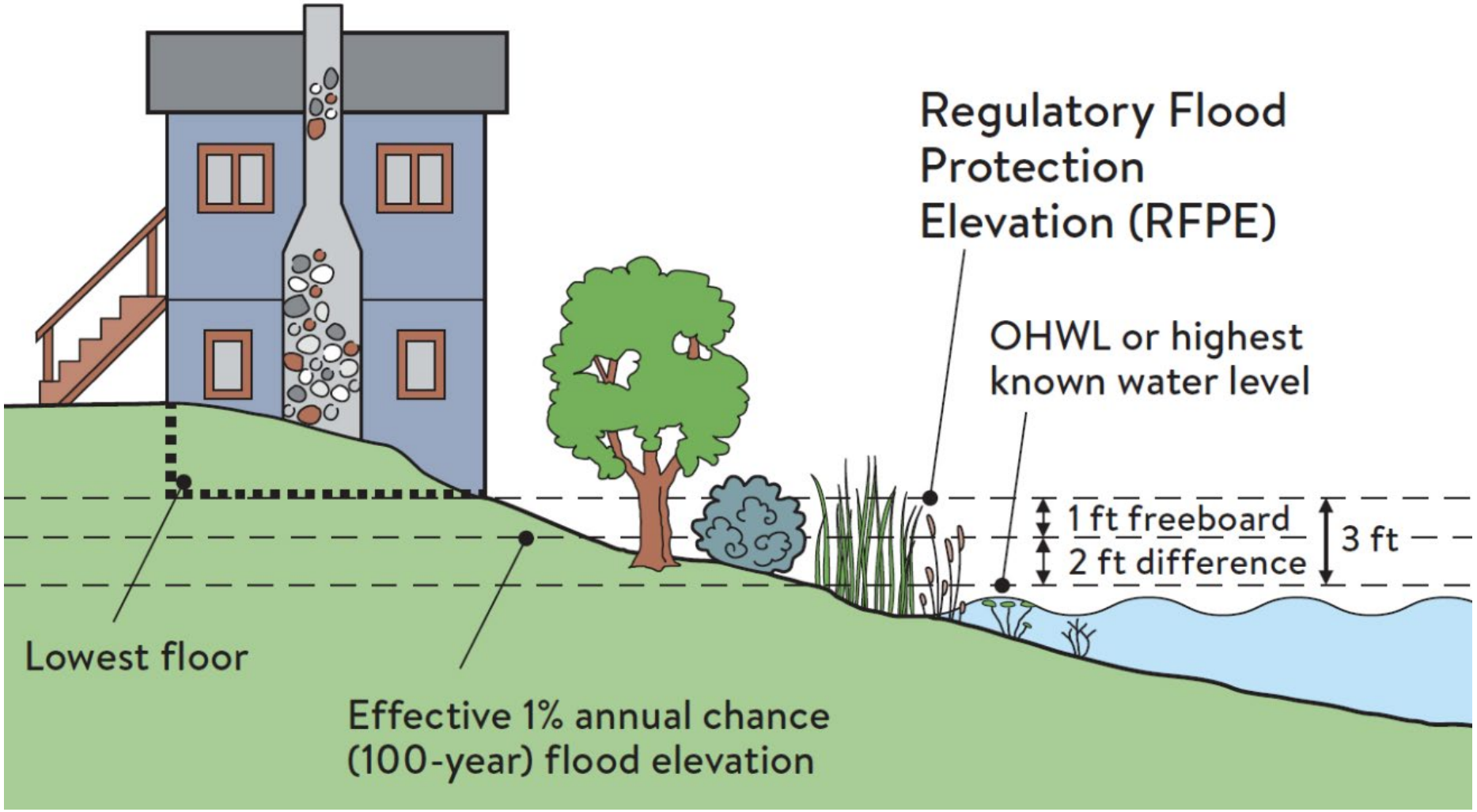
Public Waters with Shoreland

- Lakes:
  - ✓≥ 25 acres in counties
  - ✓≥ 10 acres in cities
- Lakes includes “Type 3, 4, & 5” wetlands
- Watercourses draining > 2 square miles



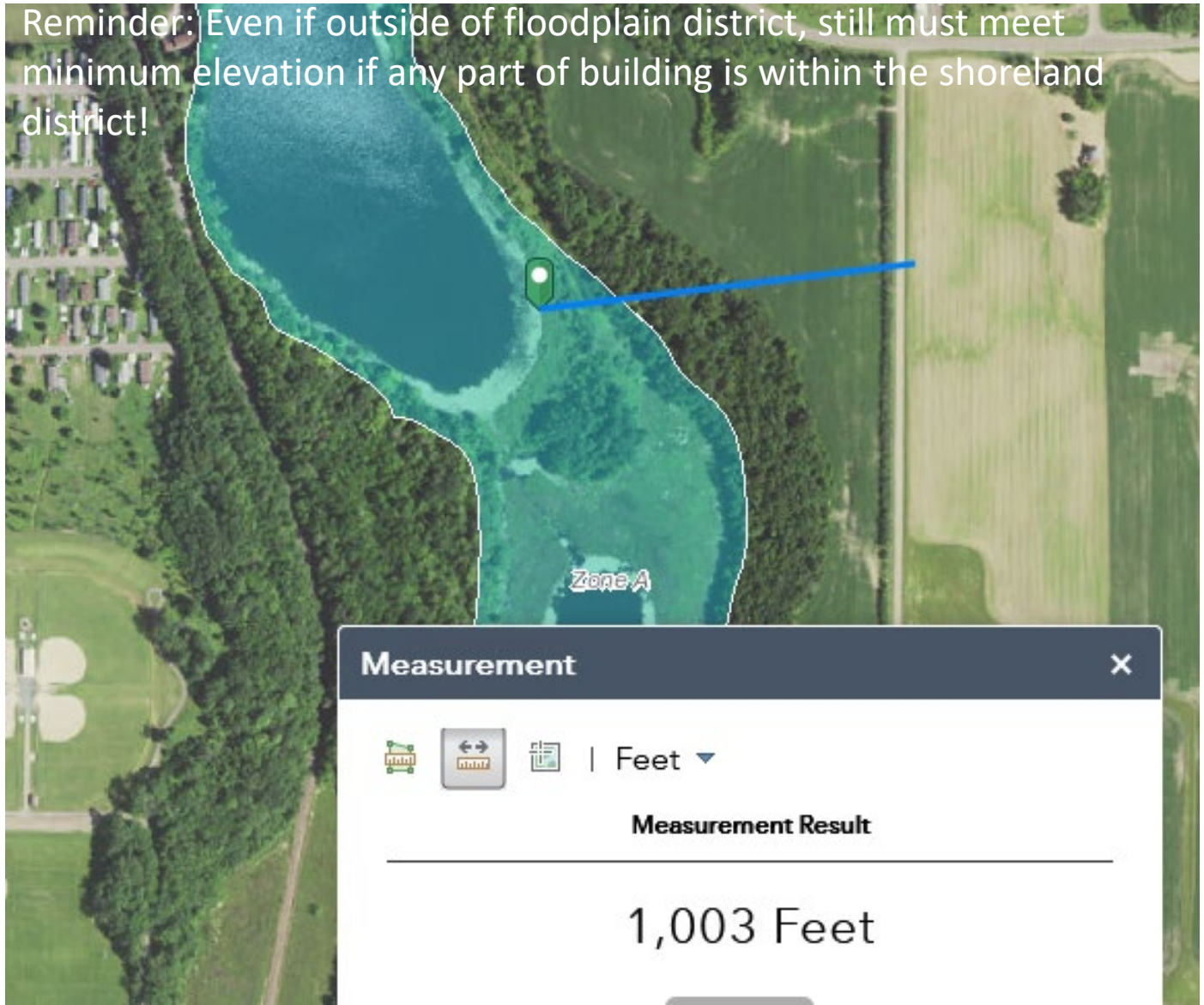
Minimum Elevation Standard

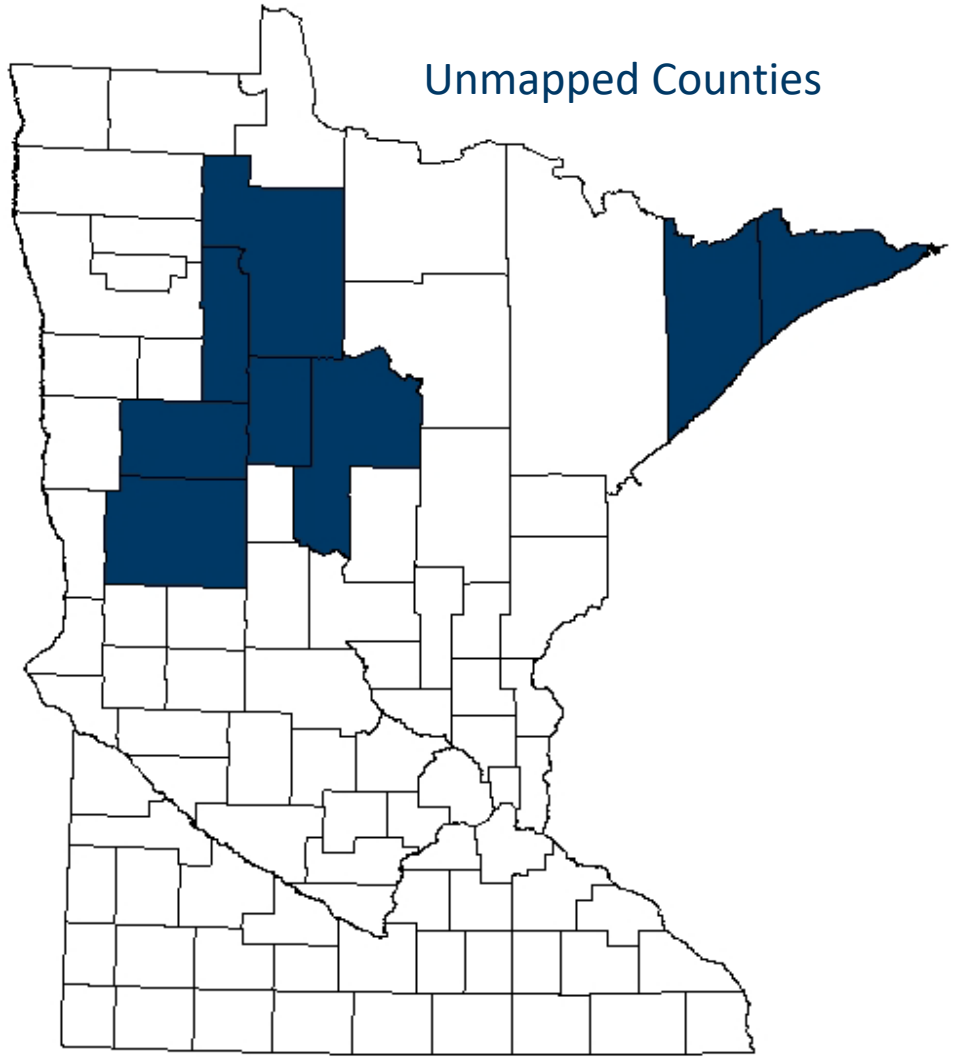
- Applies within whole Shoreland District, whether in or out of mapped floodplain
- If no BFE determined, use highest of OHWL or HKWL plus 3 feet for lowest floor



Minimum Elevation Standard2

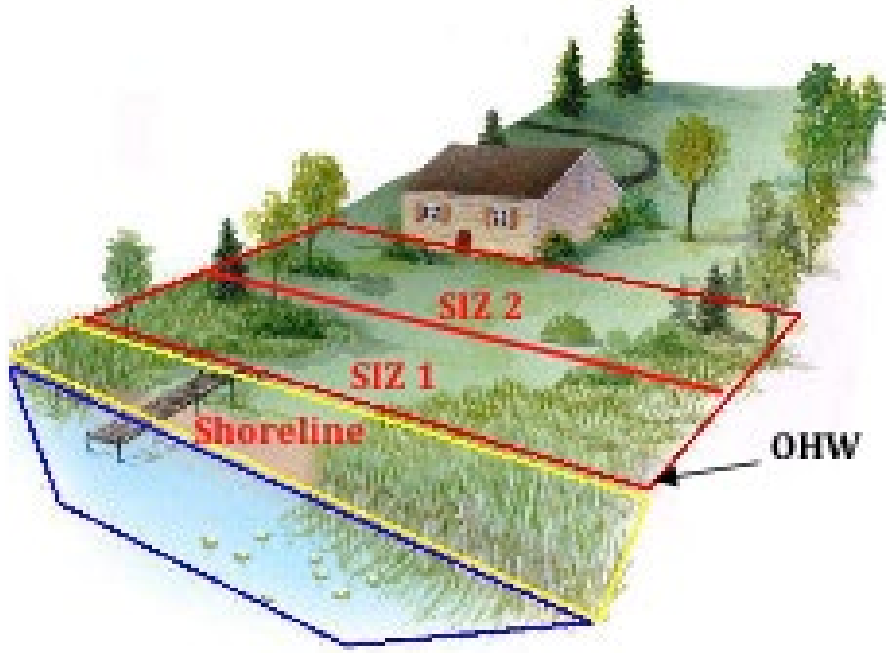
Reminder: Even if outside of floodplain district, still must meet minimum elevation if any part of building is within the shoreland district!





Example Shoreland Regulatory Requirements

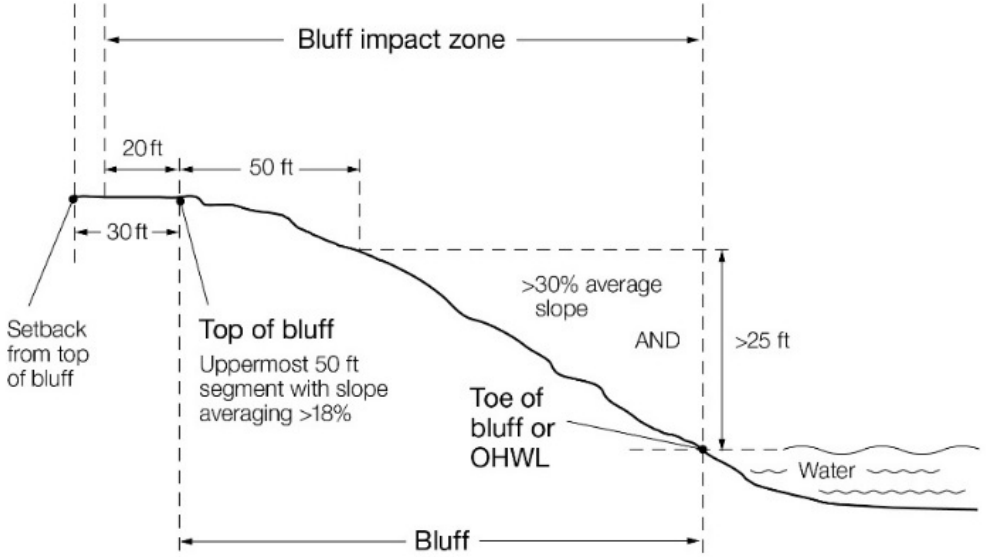
Lot size



Structure & septic setbacks from OHWL;
Limits in Shore Impact Zone (SIZ)

Vegetation management,
Aesthetics/screening

Example Shoreland Regulatory Requirements2

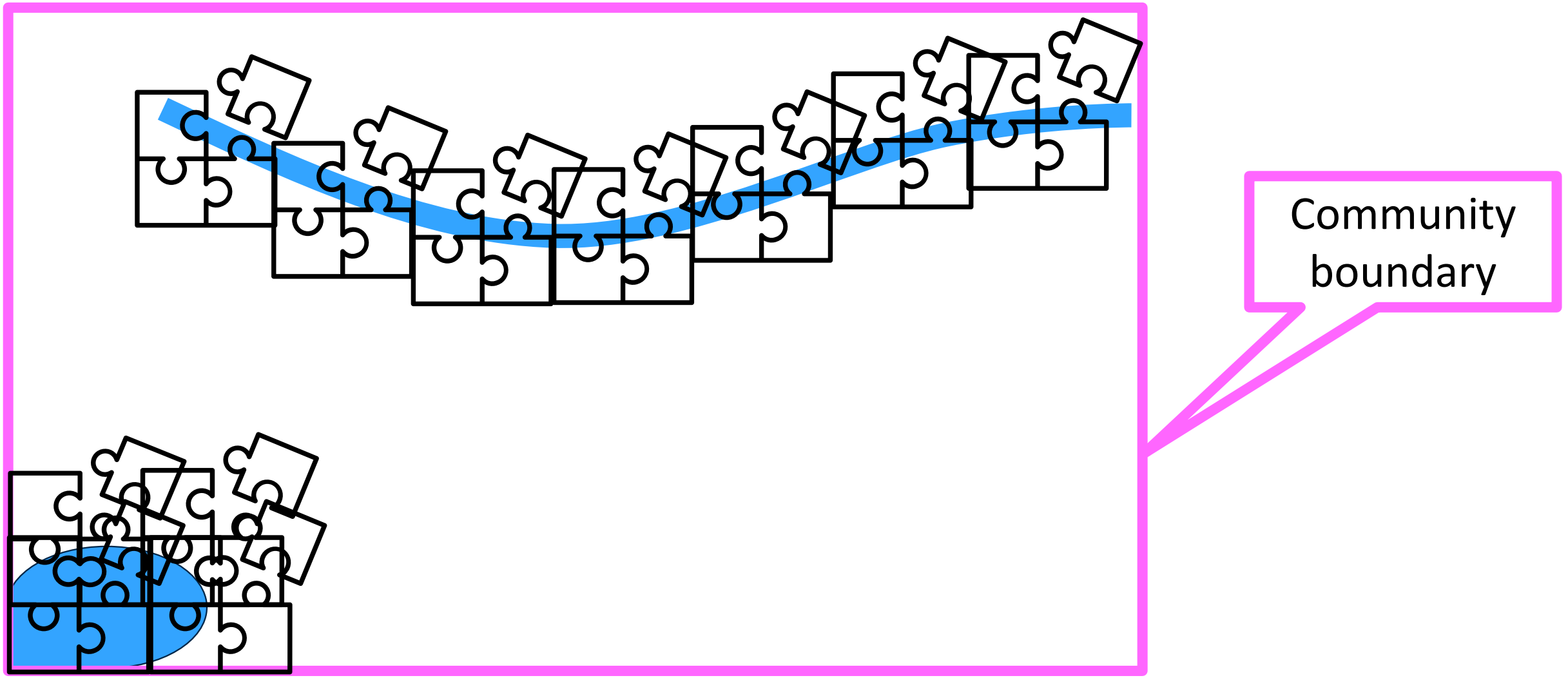


Impervious Surface Limits

Bluff protections: Why?

- Risk to property
- Erosion & sedimentation
- Loss of natural scenic beauty through visible placement of structures

State Laws Are Only Part of the Puzzle to Help Walter



Other Natural Benefits / Balancing

- Less loss of shoreline and erosion (less spent on expensive repairs)
- Flooding (public safety; costs to repair/replace)
- Water quality (tied to higher property values)
- Habitat

What Can Communities Do?

Use variety of tools:

- Higher regulations
  - Watershed level planning & prioritizing
  - Risk communication
  - Updated policies for community actions
  - Educate on options / Encourage / cost-share

Examples of Higher Standards in MN Model Floodplain Ordinance

In MN model floodplain ordinance with **blue bold** & note it's optional:

- Critical Facilities outside of .2% (or higher freeboard)
- Dry land access: no more than 2' below RFPE (0.5-1' below BFE)
- Cumulative substantial improvement determination (since ordinance adopted) – could specify other time period (i.e., 10 years)
- Substantial damage based on Increased Cost of Compliance (ICC) Rep Loss language

Most communities adopt these. Many fewer adopted when separate language was provided to insert.

See Innovative Shoreland Standards Showcase

[Innovative Shoreland Standards Link]

- See groupings of higher standard ideas
- Includes language from different community ordinances
- Floodplain page like this is coming

See Innovative Shoreland Standards Showcase3

Land Alteration Standards

Standards that guide land disturbance and grading activities in sensitive areas.

Examples of Land Alteration Standards (PDF)

- Prevents sedimentation and flow of nutrients into surface waters
- Reduces risk of slope and bluff failure
- Retains vegetation

Vegetation Management Standards

Standards that promote the protection and restoration of near-shore vegetation for habitat, water quality and aesthetic purposes.

Examples of Vegetation Management Standards (PDF)

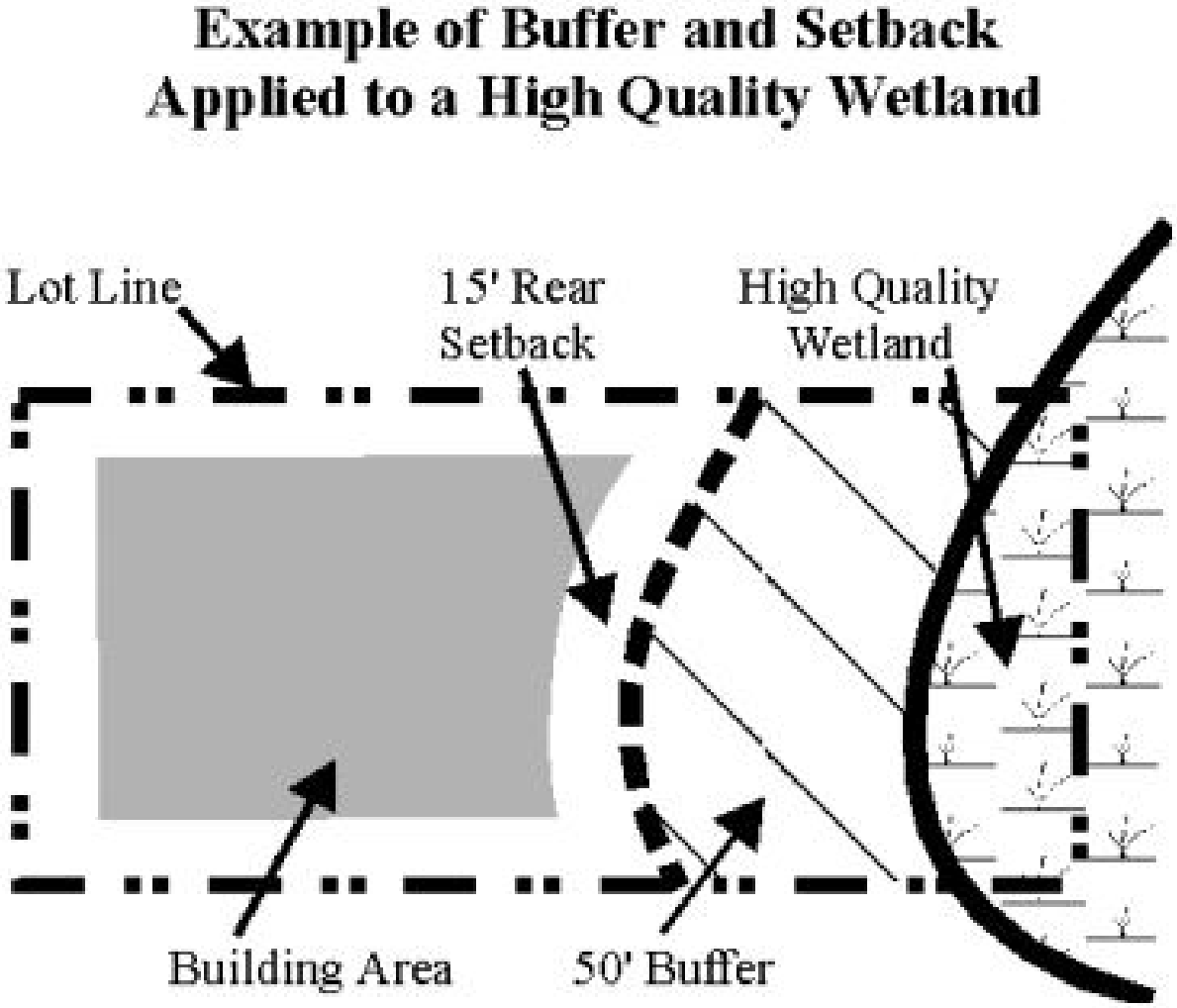
- Slows runoff into waterbodies, encouraging groundwater recharge
- Infiltrates runoff and filters nutrients and pollution
- Provides habitat
- Enhances natural lakeshore character
- Anchors the soil, reducing erosion

Plymouth Minimum Elevations & Riparian Buffers

- Lowest floor 2 ft above 1% annual flood elevation
  - ✓Applies city-wide
  - ✓City stormwater management plan with 1% annual chance flood elevations in every sub-watershed
- Wetland riparian buffers and setbacks
- Adopted early 1990s

Plymouth Wetland Riparian Buffers

- Classified Wetlands
- Riparian buffers and setbacks
- Monument requirement



Water Detention On-site Example

Community Ponding Basin

Defendable in Court?

- Consistent treatment: not “arbitrary and capricious”
- Applicable: Addresses local concerns/issues
- Defendable: Based on data/science; quantifiable

Remember – communities are most likely to lose in court because they did NOT enforce their floodplain-related regulations (especially if someone is impacted)!