



AGENDA OF THE SUSTAINABILITY COMMISSION

WEDNESDAY, APRIL 17, 2024, 5:00 PM

In person at City Hall, Room 310.

Virtual attendance also available via Zoom.

A. Zoom Meeting Information.

I. Join Zoom Meeting Online:

<https://us02web.zoom.us/j/82236285137?pwd=bzBScDVVRysrQlpSZEZpK2FMSnd4Zz09>

Or call in by phone: +1 312 626 6799

Meeting ID: 822 3628 5137

Passcode: 769016

If you wish to speak at this public meeting or leave a comment, please fill out the online [Comment Form](#) prior to the meeting. More detailed [Zoom Instructions](#) can be found online.

B. Roll Call.

- I. Chair-** Seth Hoffmeister; **Vice Chair-** Ned Dorff; Jenny Brinker; Amy Kox; Christa Kananen; Kaurie Mihm-Staff person; Julia Noordyk; Mark Walter, Elected Alderperson

C. Approval of the Agenda.

- I. Approval of the Sustainability Commission meeting agenda for April 17, 2024.**

D. Approval of Minutes.

- I. Approval of minutes from March 20, 2024.**

E. Presentations

- I. Past, Present, and Future Climate Hazards for Green Bay**

This presentation looks at Green Bay's changing climate patterns over the past century and into the future. It also will cover increasing climate hazards that our community faces and provides several vulnerability analyses for rainfall flooding, extreme heat, and coastal flooding

risks.

Presenters:

Abdullahi Bihi, WICCI Project Assistant, Wisconsin Sea Grant

Adam Bechle, Coastal Engineering Outreach Specialist, Wisconsin Sea Grant

Julia Noordyk, Water Quality & Coastal Communities Specialist, Wisconsin Sea Grant

F. Regular Business.

1. Discussion and possible action to make a presentation to the Common Council of the 2024-2025 Sustainability Commission work plan in June 2024.

G. Informational.

1. Review the amended 2024-25 Sustainability Commission Work Plan from March 20, 2024 meeting.
2. Resiliency Coordinator Report
3. The meeting for May 15 will be canceled.
4. Next Sustainability Commission meeting: **June 19** at 5:00pm.

H. Adjournment.

- 1) THIS MEETING IS RECORDED: THE VIDEO OF THIS MEETING AND MINUTES ARE AVAILABLE ONLINE AT www.greenbaywi.gov
- 2) ACCESSIBILITY: Any person wishing to attend who requires special accommodation because of a disability, should contact the City Safety Manager at 920-448-3125 at least 48 hours before the scheduled meeting time so that arrangements can be made.
- 3) QUORUM: Please take notice that a majority or quorum of the Common Council will attend this Sustainability Commission meeting and will constitute a meeting of the Common Council for purposes of discussion and information gathering relative to this agenda.
- 4) REPRESENTATION: The party requesting the communication, or their representative, should be present at this meeting.

Past, Present, and Future Climate Hazards for Green Bay



Abdullahi Bihi, WICCI Project Assistant

Adam Bechle, Coastal Engineering Outreach Specialist

Julia Noordyk, Water Quality & Coastal Communities Specialist





Climate Resilience Work Group

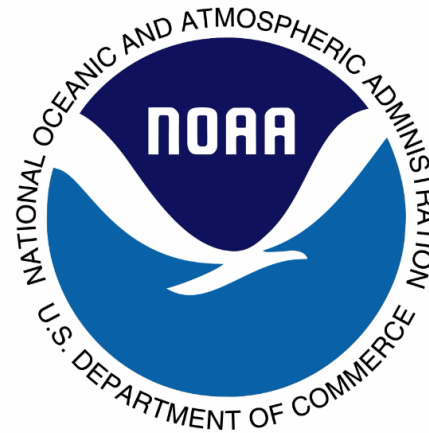
- 1) Outline local climate changes, projections and impacts
- 2) Identify specific areas and residents at risk





Abdullahi Bihi
UW-Madison, Urban
and Regional Planning
MS Student
UW Sea Grant,
Project Assistant

Sources



**US Army Corps
of Engineers®**



National Climate Assessment

Storm aftermath



PRECIPITATION

June 24, 1990

+4.9" rain in 24hrs

50-year storm
(2% annual chance)

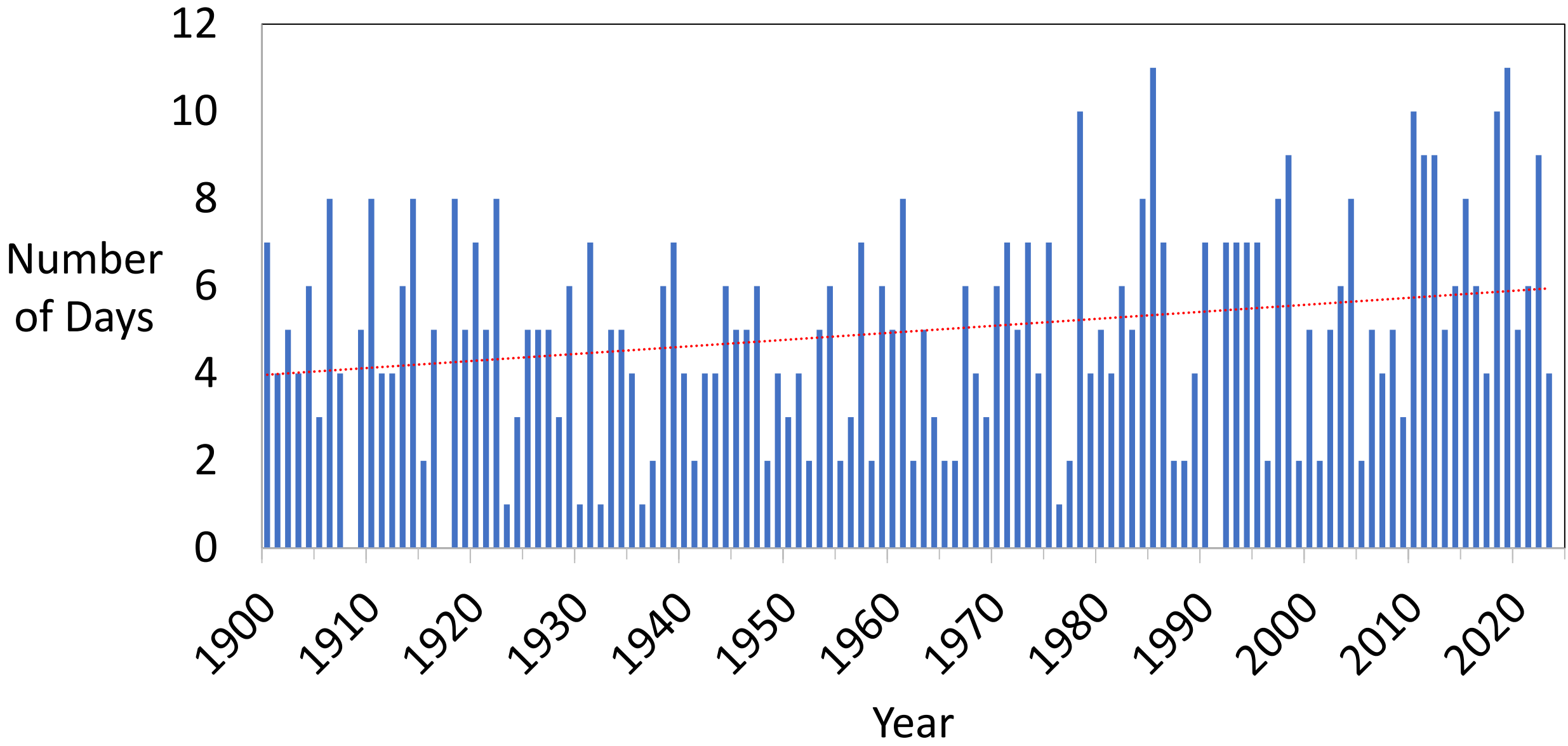
Average lake levels

\$11M damages

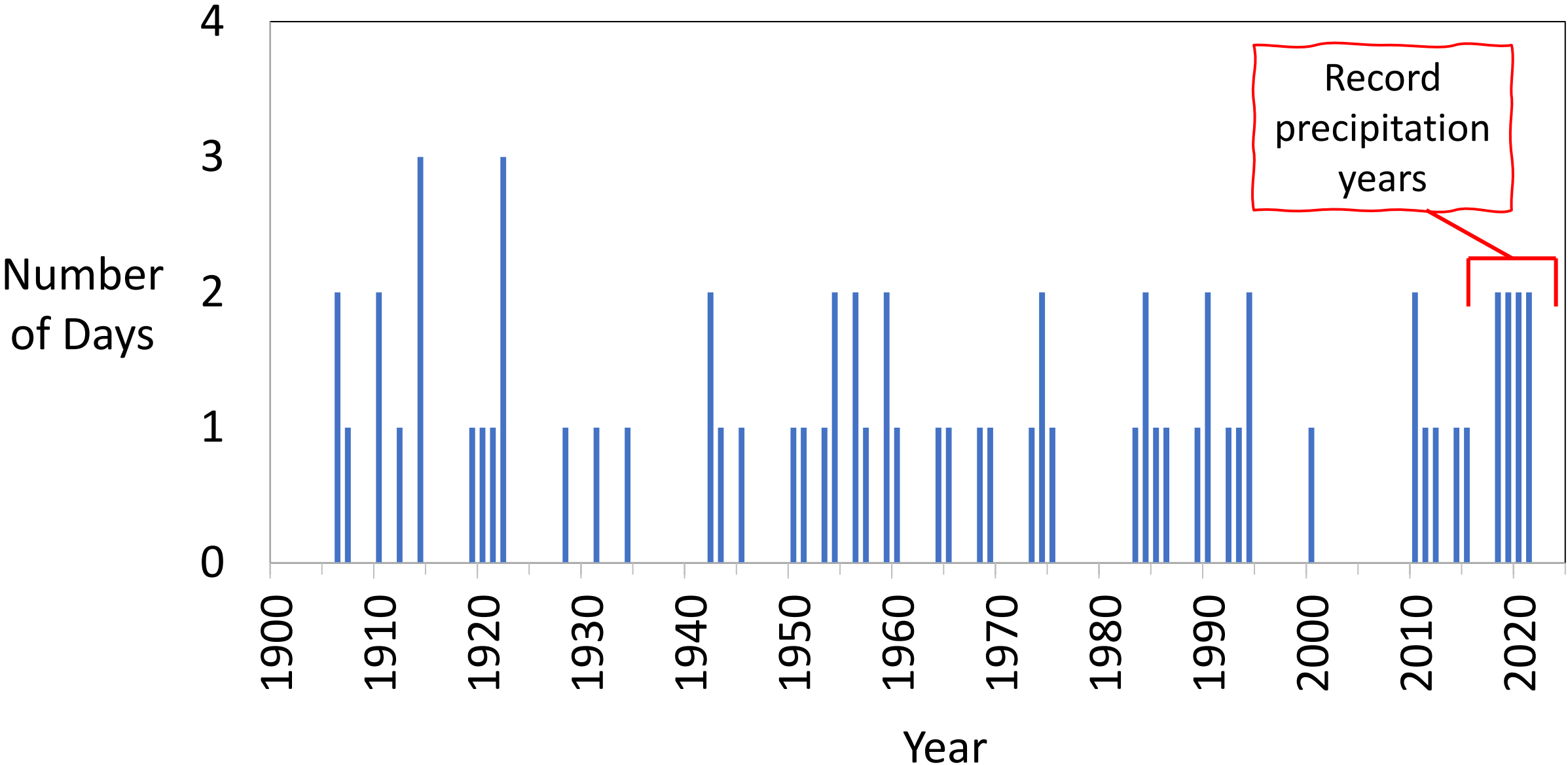
200 homes affected

Kiwanis Park in Allouez, Green Bay Press-Gazette

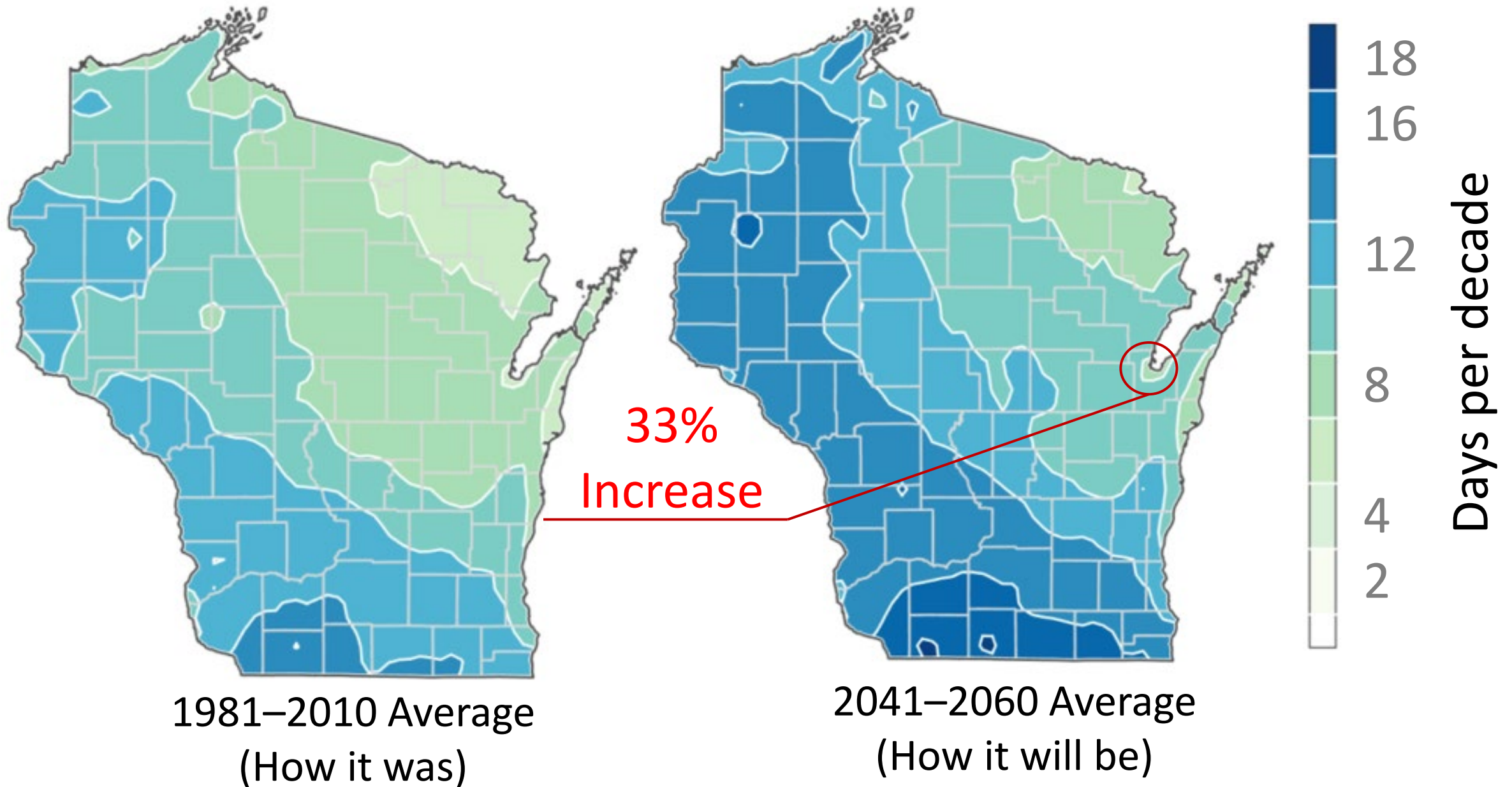
Days of More than 1" of Rainfall



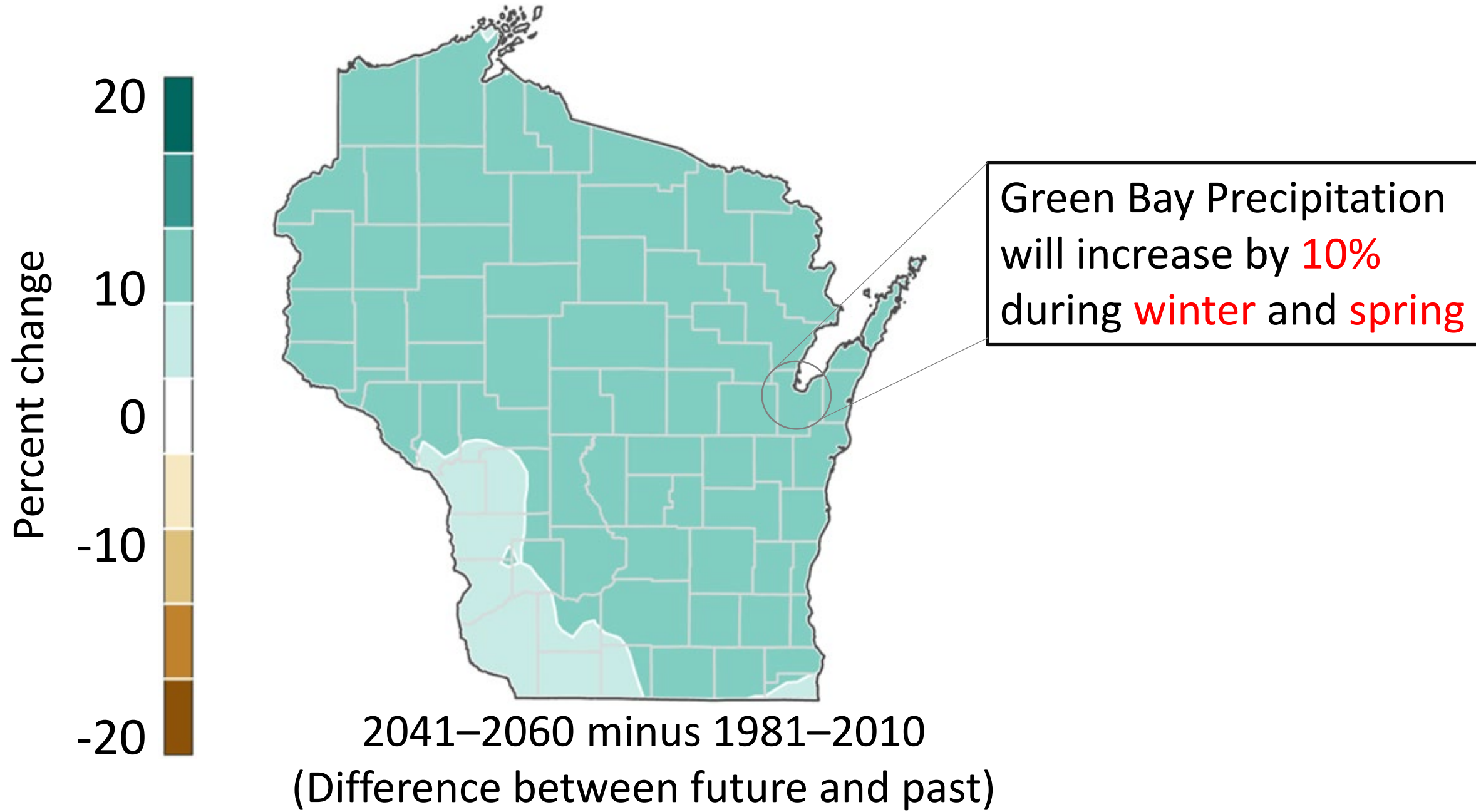
Days of More than 2" of Rainfall



Days per Decade of Large Rain Events (>2")



Projected Change in Average Rainfall in Winter and Spring



Flooding Social Vulnerability Analysis



ond Perock
[UNANIMOUS]
approval. Motion
d Quigley
[UNANIMOUS]
vide items
nt. Motion
d Perock to
eting at 8:19
[US]
bmitted, City
nen Publish
[LP]

IFIEDS

7005

ting at it's best.
0,000 homes in
1 Upper Michigan.
over 20 newspa-
ers. Just go to
themcon.com
and affordable.



Fresh Xpress

ood. Delivered.

Food Delivered To
ce Order By 10 pm
for Friday Delivery
freshxpress.com

September was one for the record books

In an interesting alignment of events this year, the arrival of September marked the beginning of the extended Labor Day weekend, and the weather could not have been more perfect, gracing us with beautiful conditions throughout the holiday weekend.

From Friday, Sept. 1, to Monday, Sept. 4, the skies were mostly sunny, accompanied by a pleasant breeze and summery warmth, with two days setting record-breaking high temperatures — 92 degrees Fahrenheit on Sunday, Sept. 3, and 91 degrees on Monday, Sept. 4.

However, the heat, combined with the dry conditions and gusty winds, also brought an elevated fire risk and folks were reminded to be careful with bonfires and grills as they enjoyed their holiday celebrations.

As the month progressed, temperatures mellowed, offering a taste of more typical autumn



Weather Watch

BY BRAD SPAKOWITZ
WBAY METEOROLOGIST



September's dry weather helped to change down some leaves a bit earlier this year, as seen along one of the fine Baird Creek trails on Green Bay.

Brad Spakowitz

hardly enough to settle the dust.

As September ended, the official National Weather Service data from Green Bay indicated a meager total of 0.51 inches of rainfall, a staggering 2.69 inches below the 30-year norm, placing September 2023 as

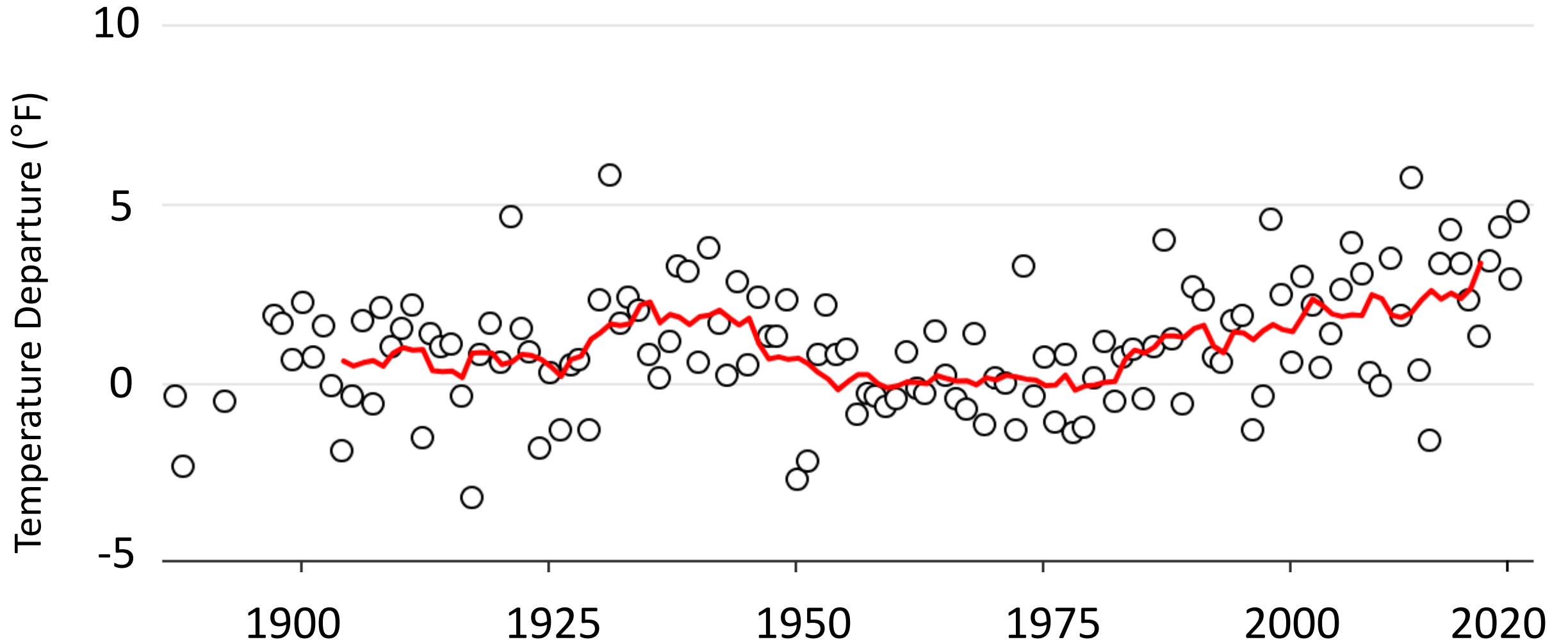
October cha

The typical of an unfal will abound: The changing of leaf colors and falling leaves, flocks of birds and the honks of geese overhead and a lower sun angle with correspondingly lon-

TEMPERATURE

With the two days with temperatures at or above 90 degrees early in the month, our total count for such scorching days this year reaches 11, far surpassing the annual average of 5.5.

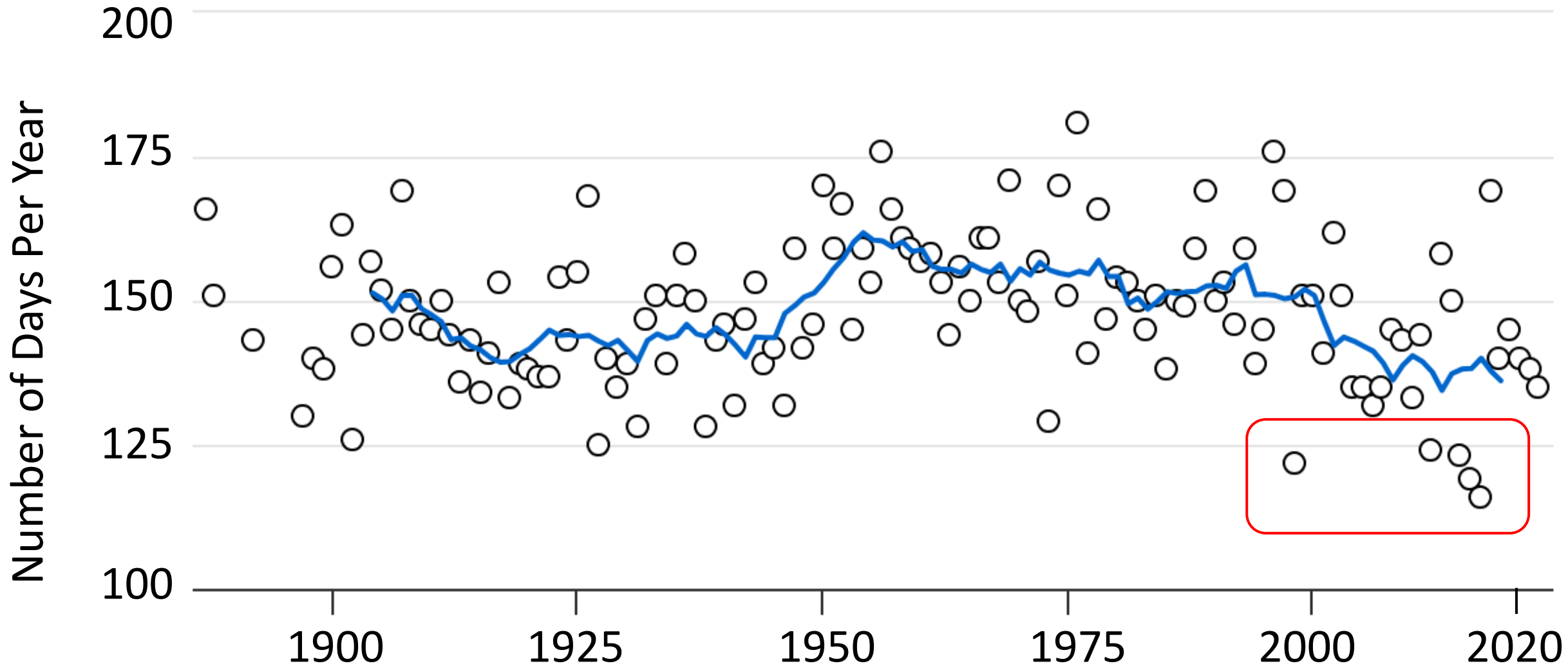
Green Bay: Annual Temperature Departure



Change in ANNUAL
average temperature = **+3.5°F**

○ Average Departure (°F) — 9-years Average

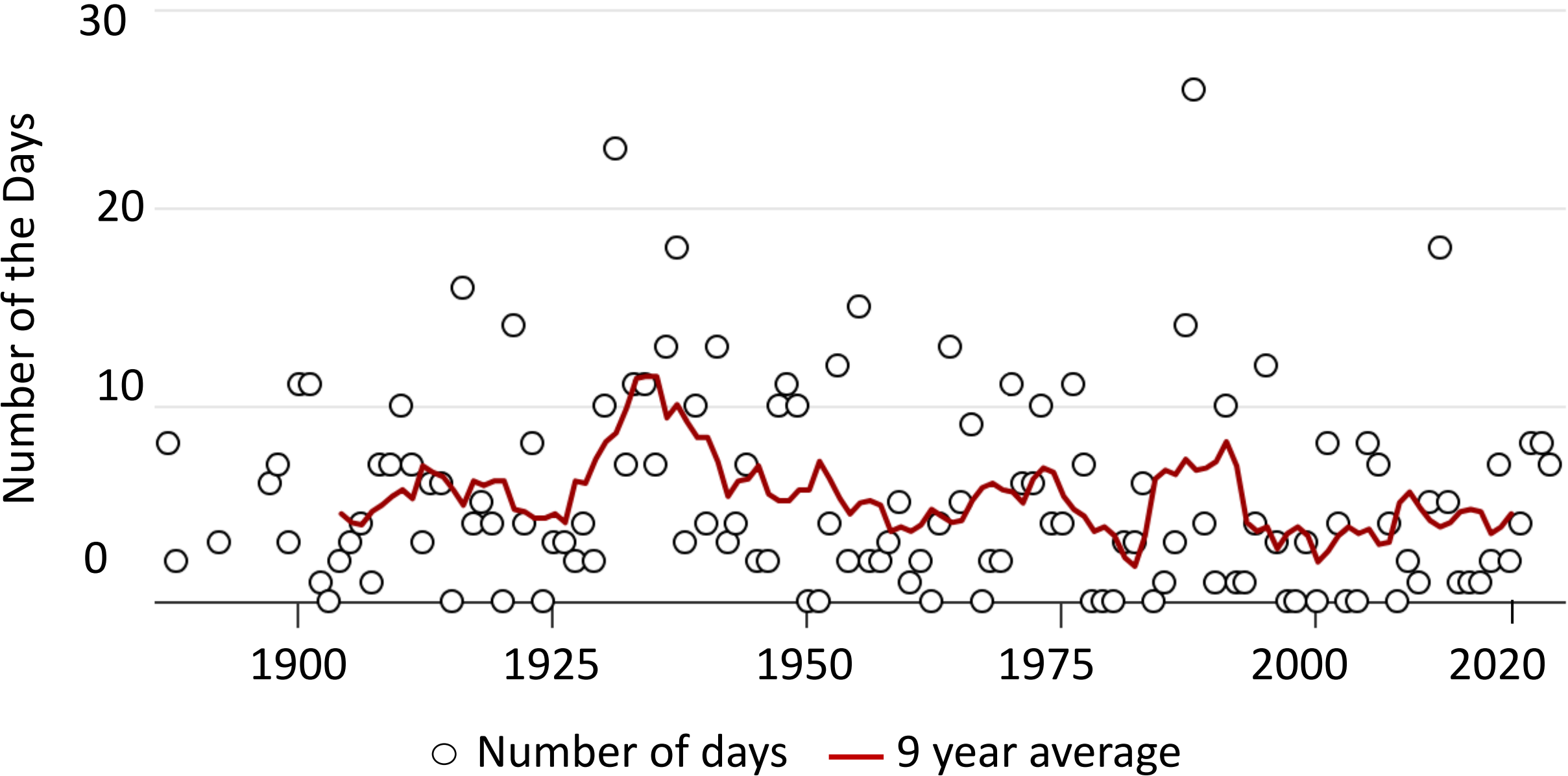
Green Bay: Days Below Freezing (<32°F)



Change in WINTER
average temperature = **+5.3°F**

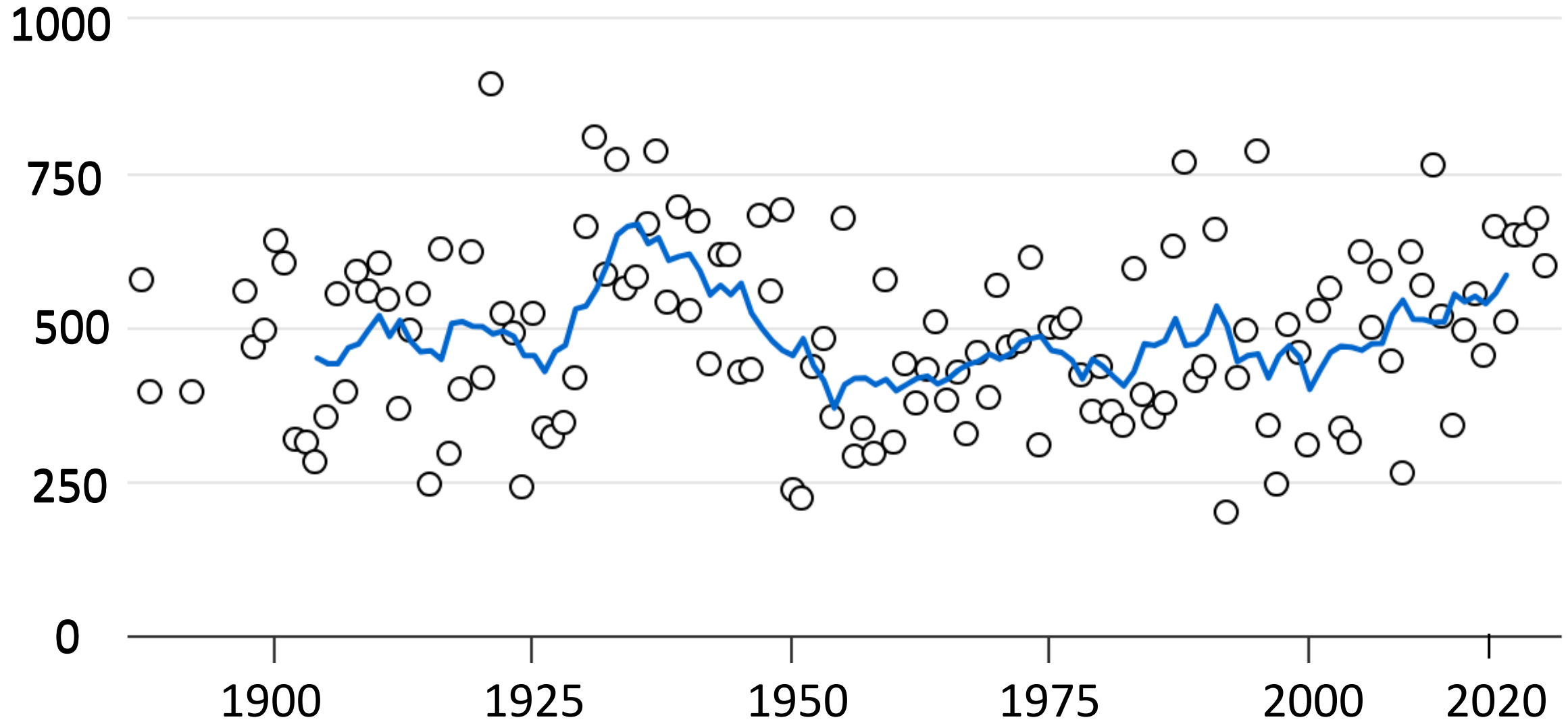
○ Number of days — 9-year average

Green Bay: Days of Extreme Heat (>90°F)



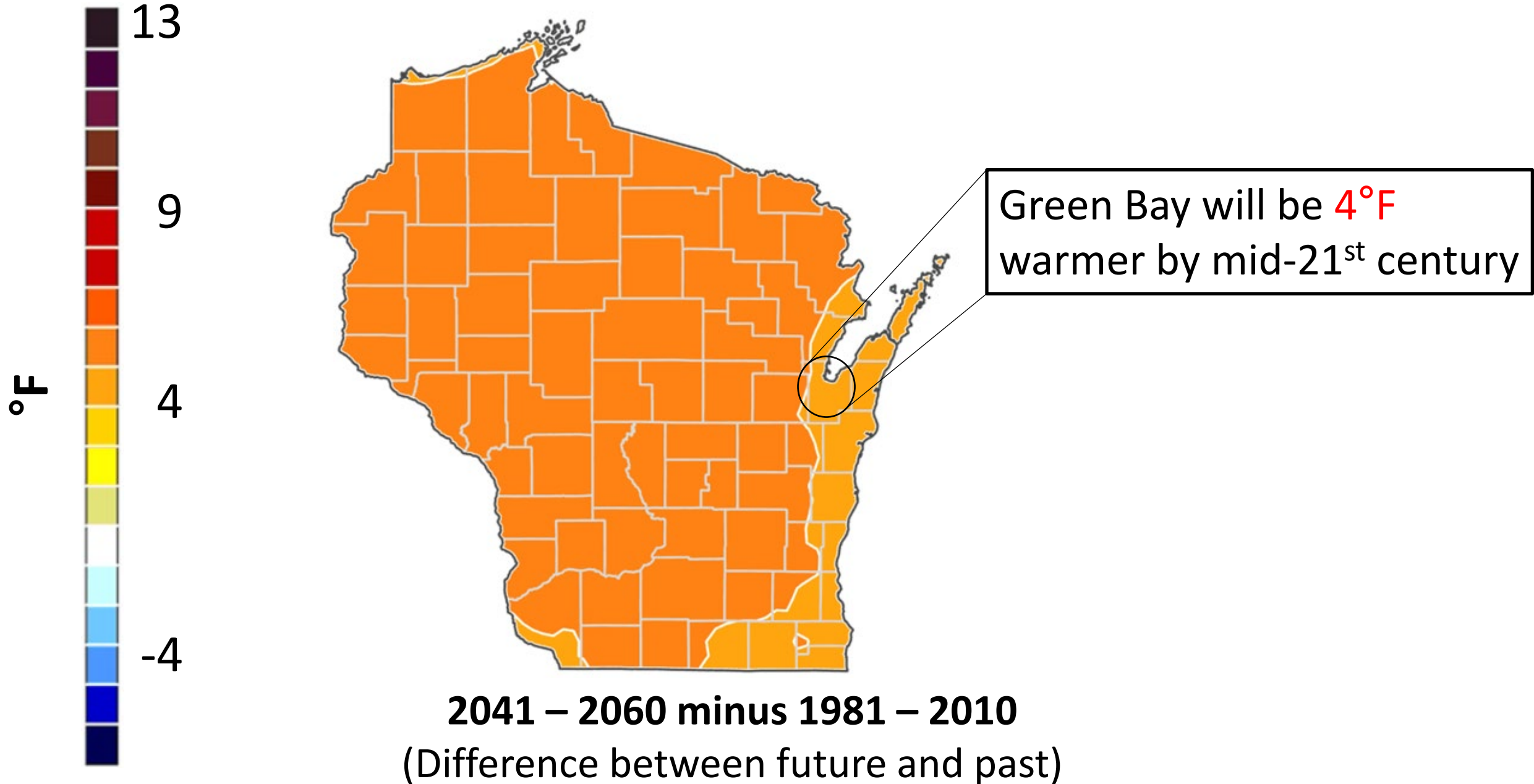
Green Bay: Air Conditioning Days

Cooling Degree Days
(indexed unit)

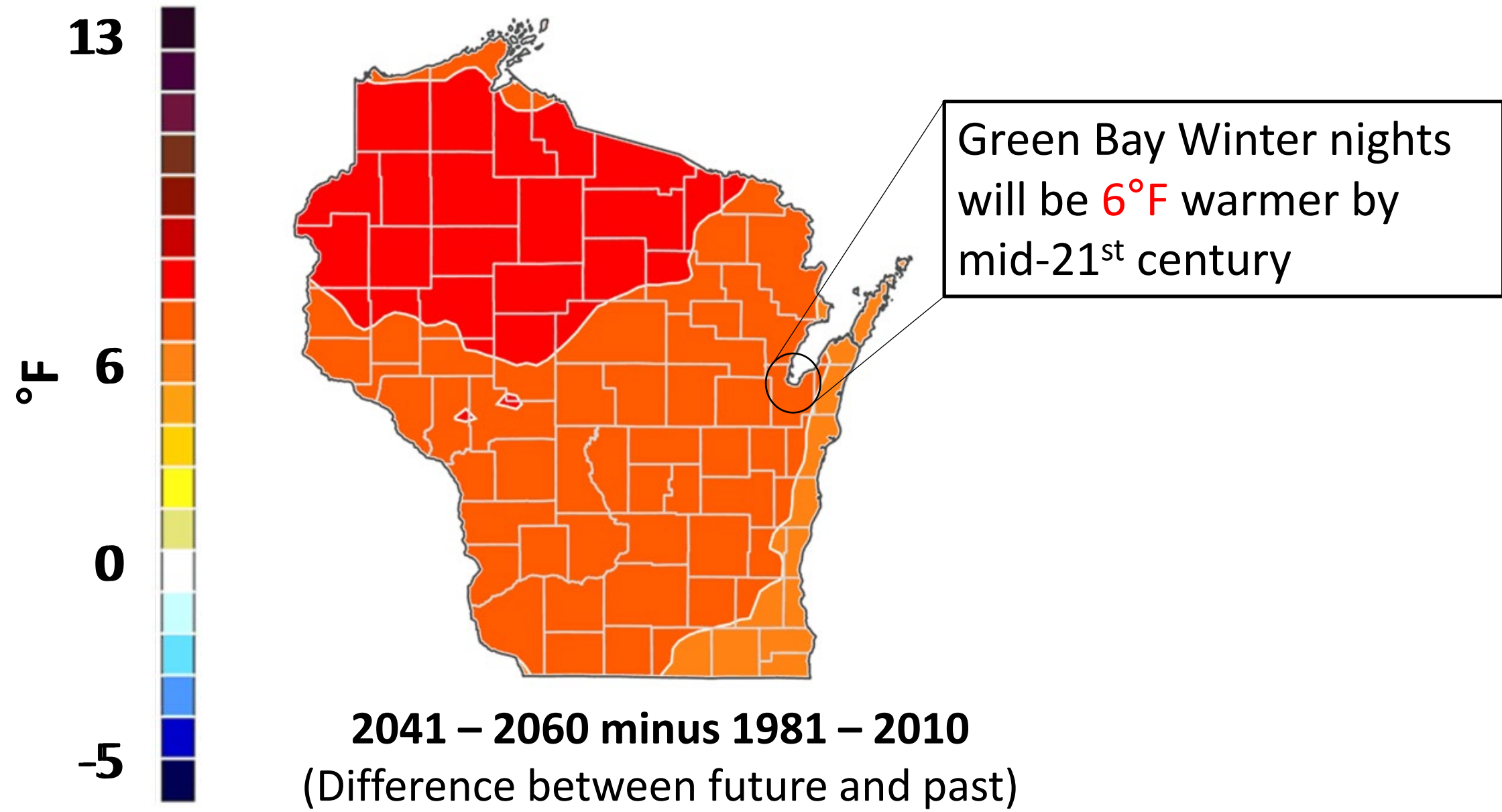


○ Number of days — 9 year average

Projected Change in Average Annual Temperature (°F)



Projected Change in Winter Nights Annual Average Temperature (°F)



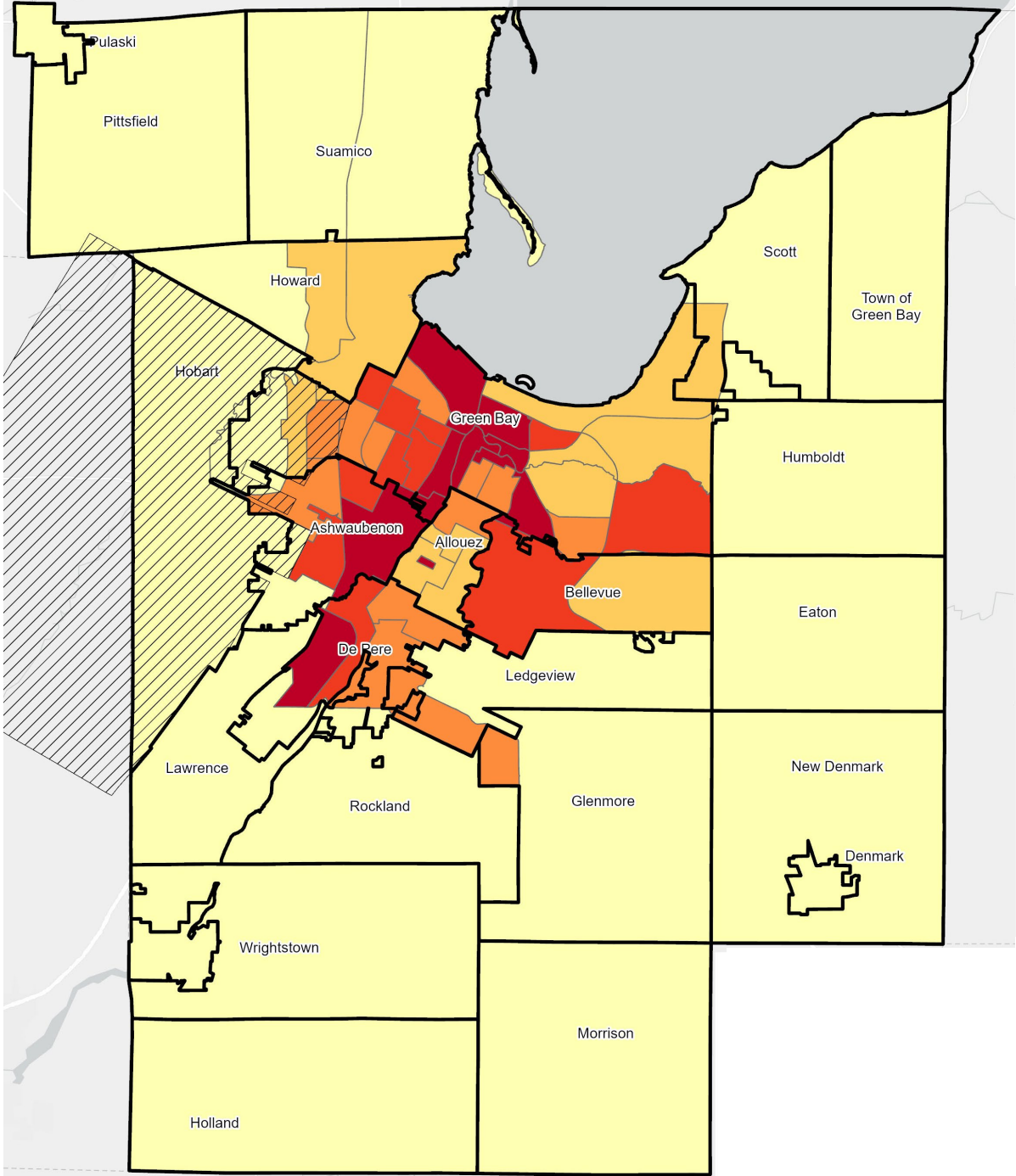
Who's most at risk from extreme heat?

Heat Vulnerability Index

Exposure
+
Sensitivity
+
Adaptive Capacity

Photo: Green Bay Press-Gazette

Exposure



 Municipal Boundary

 Oneida Reservation

Exposure to Extreme Heat

 5 (High)

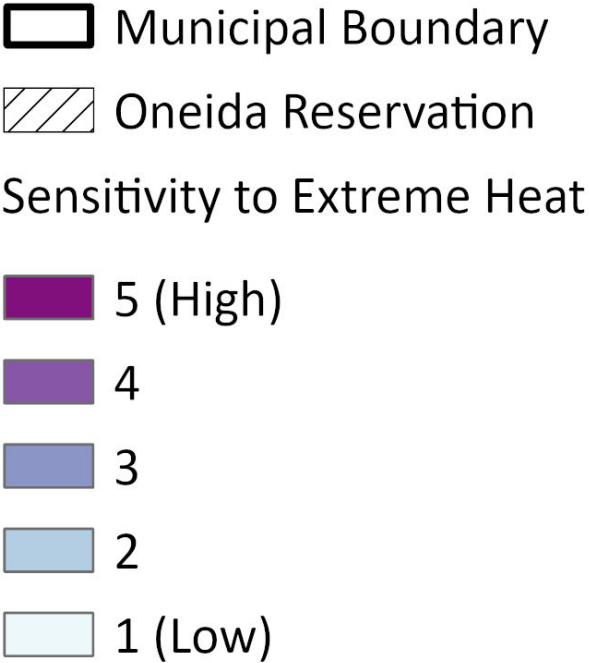
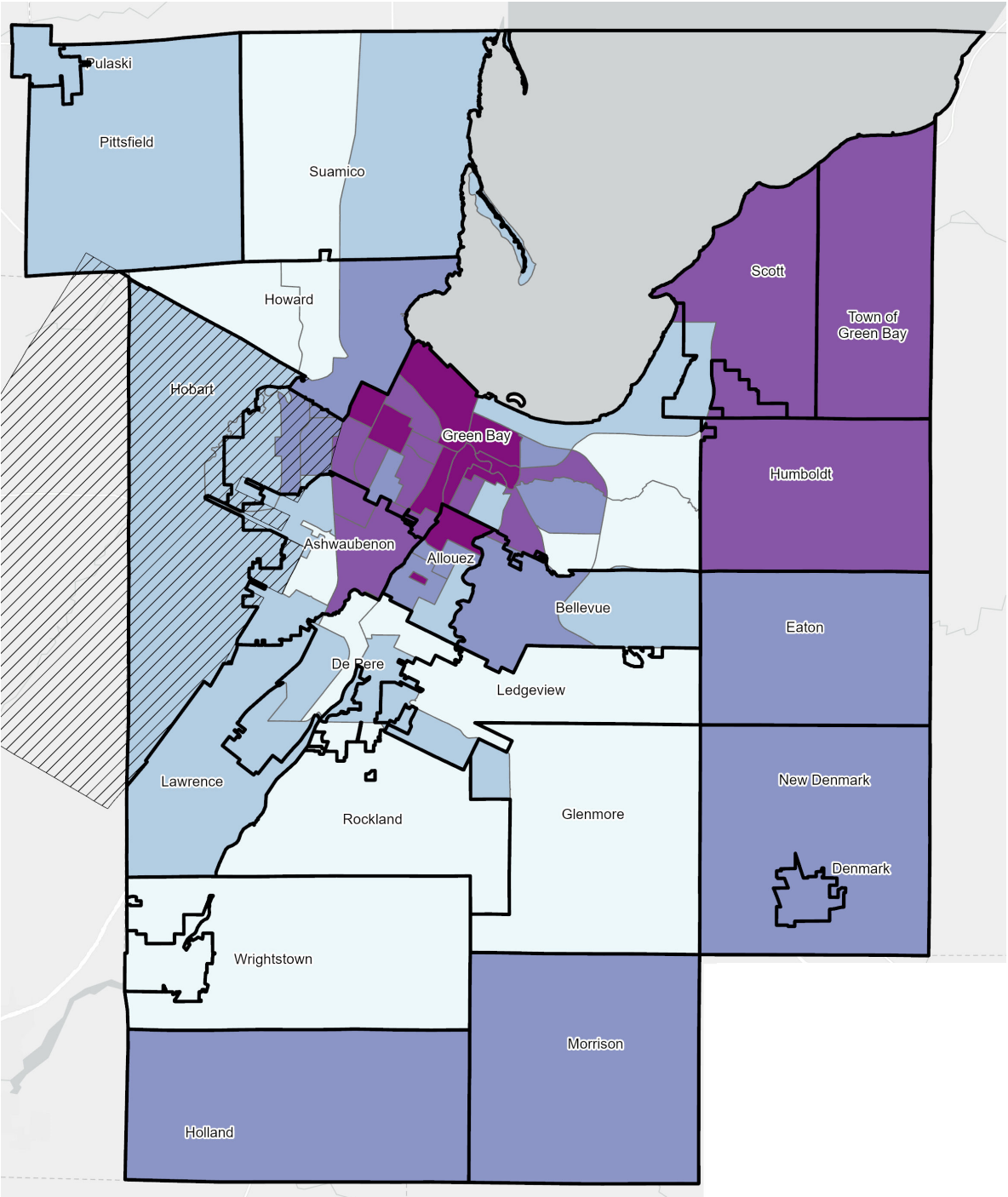
 4

 3

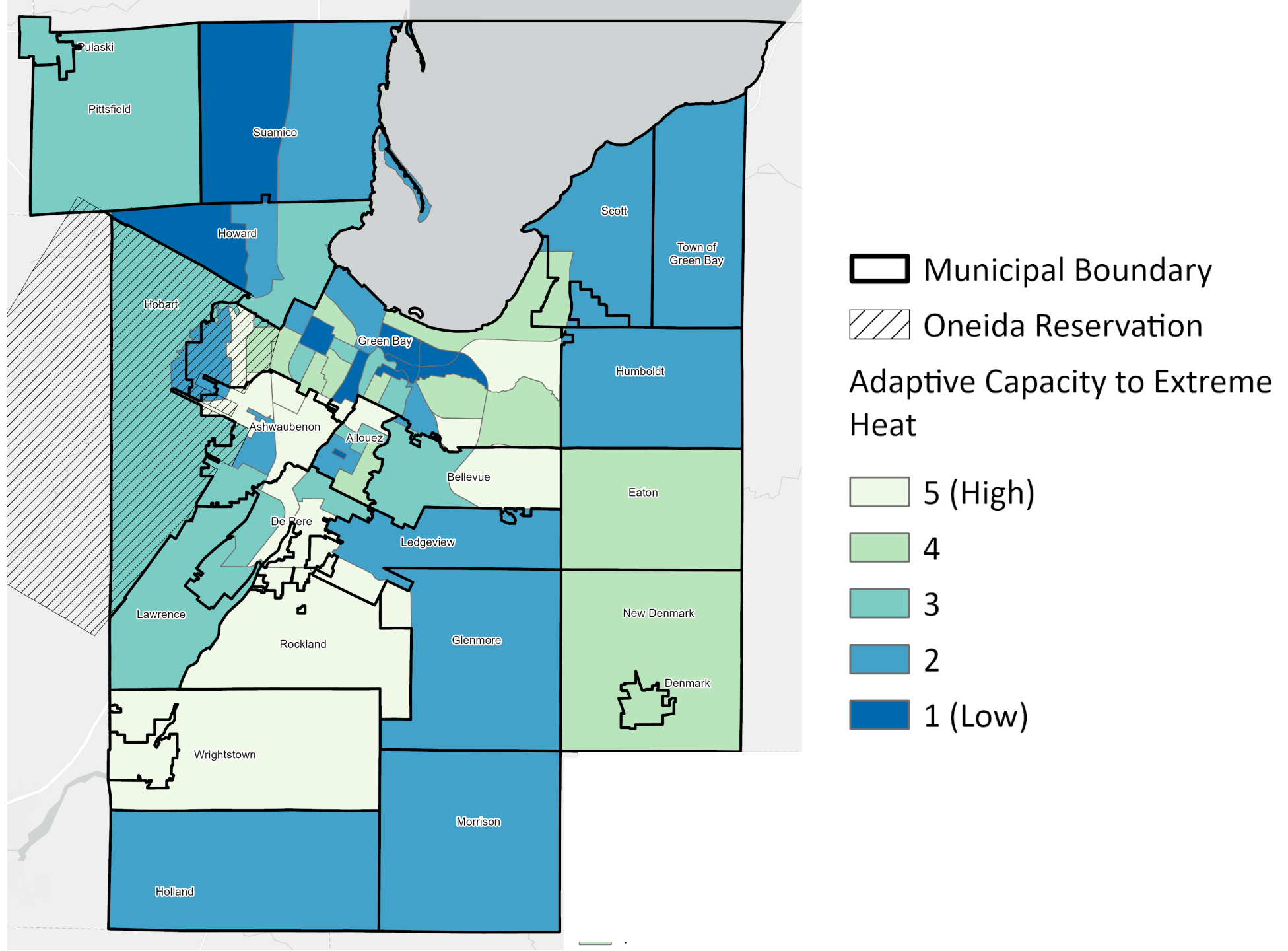
 2

 1 (Low)

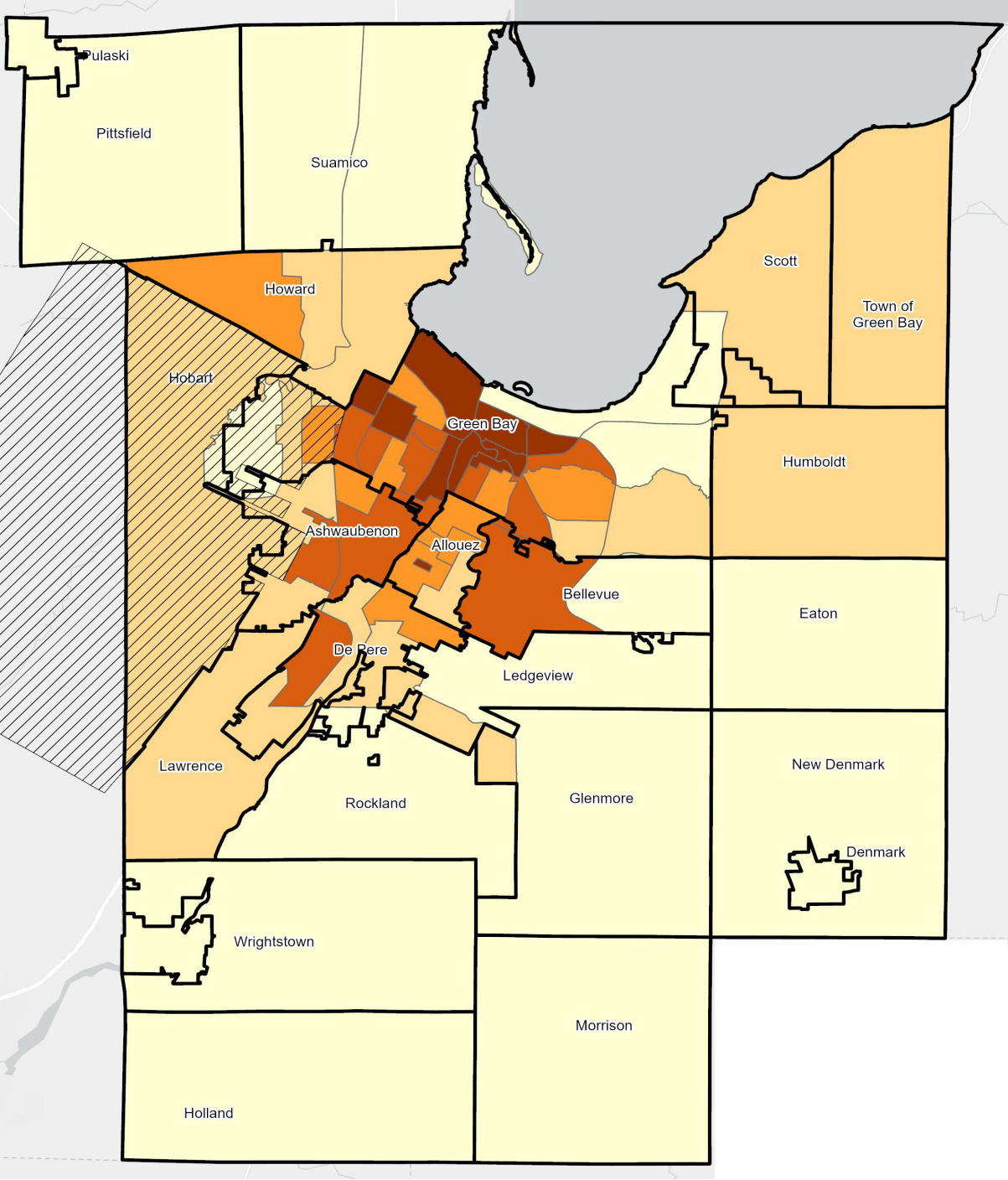
Sensitivity



Adaptive Capacity



Heat Vulnerability Index for Brown County



 Municipal Boundary

 Oneida Reservation

Heat Vulnerability Index

 5 (Highest)

 4

 3

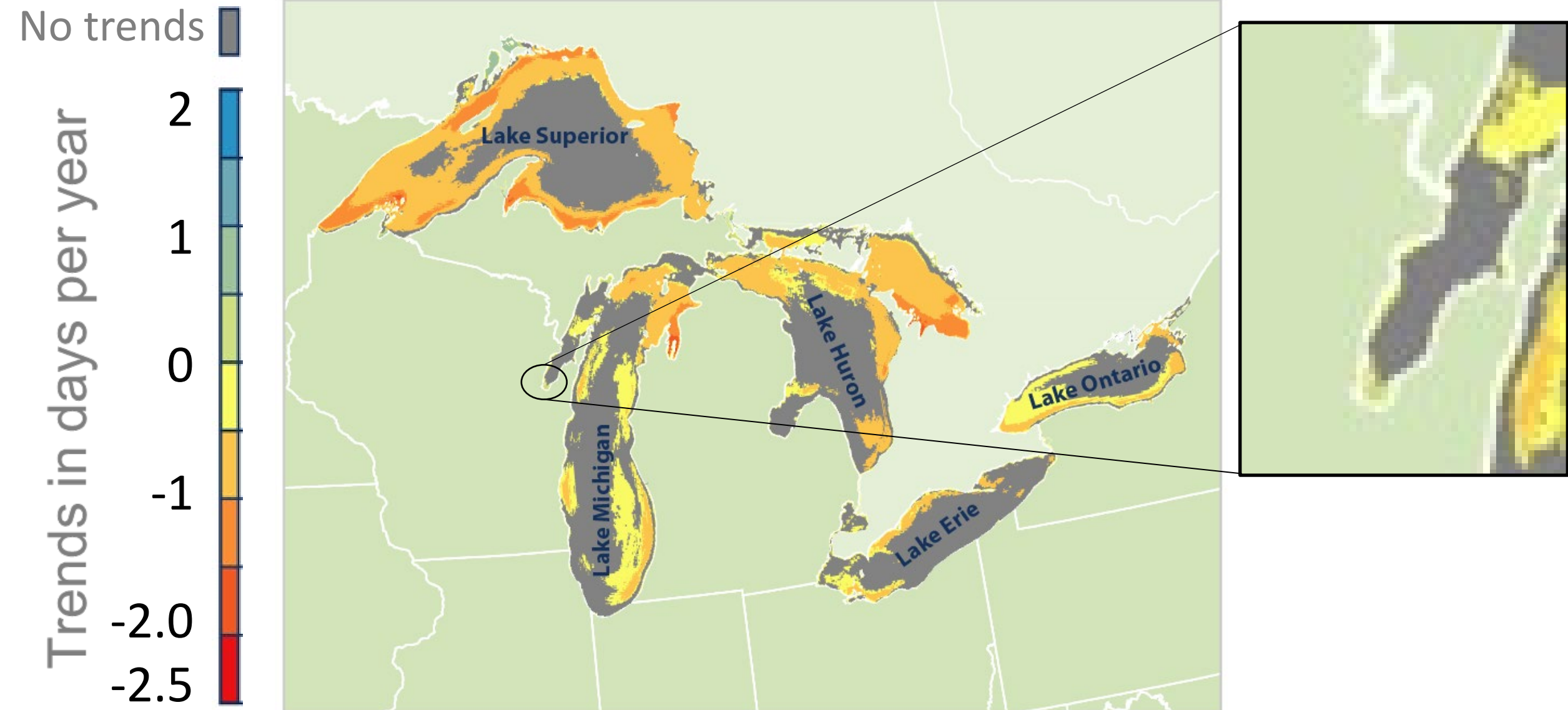
 2

 1 (Lowest)

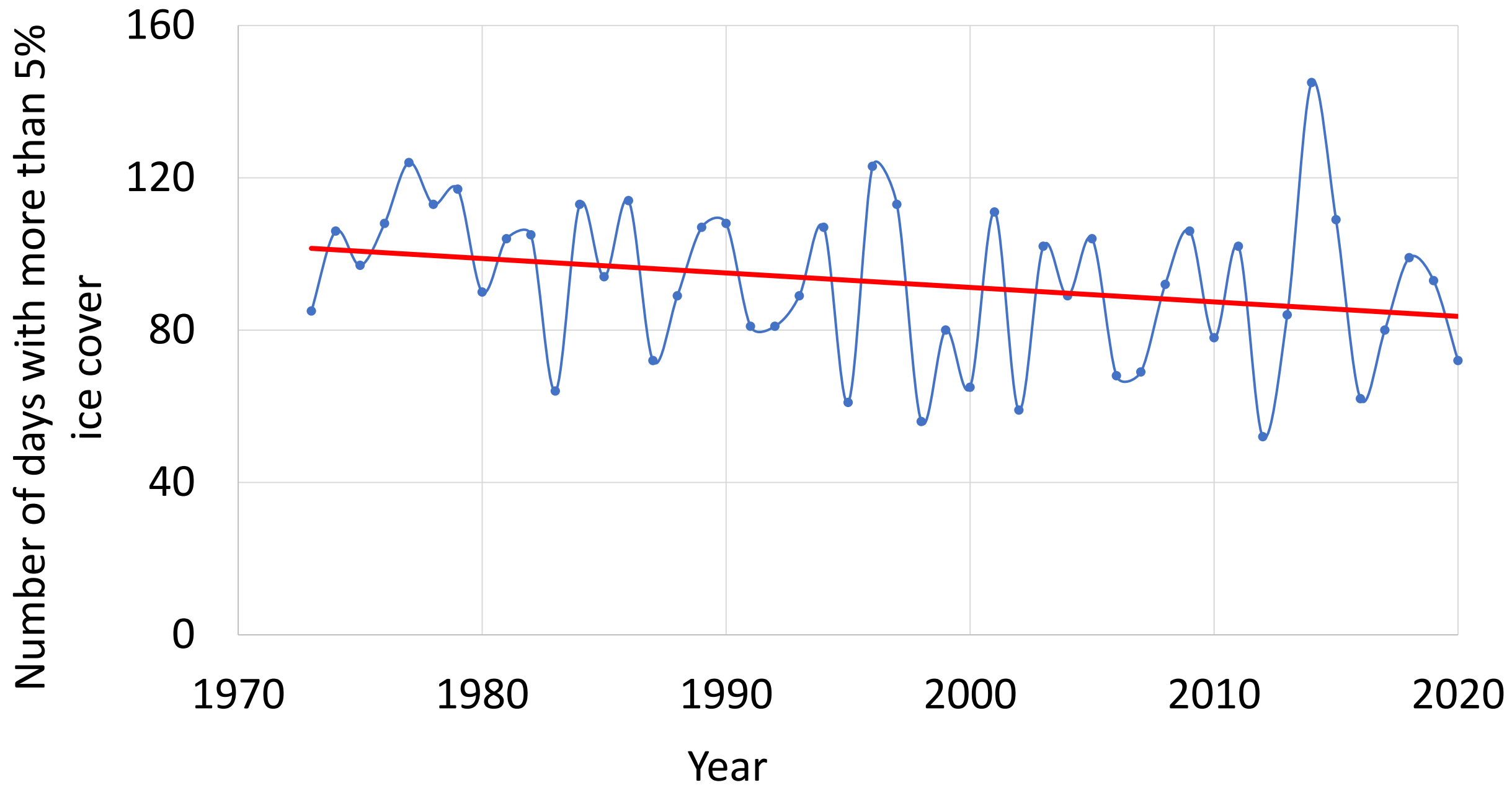


What will happen to Green Bay's ice cover?

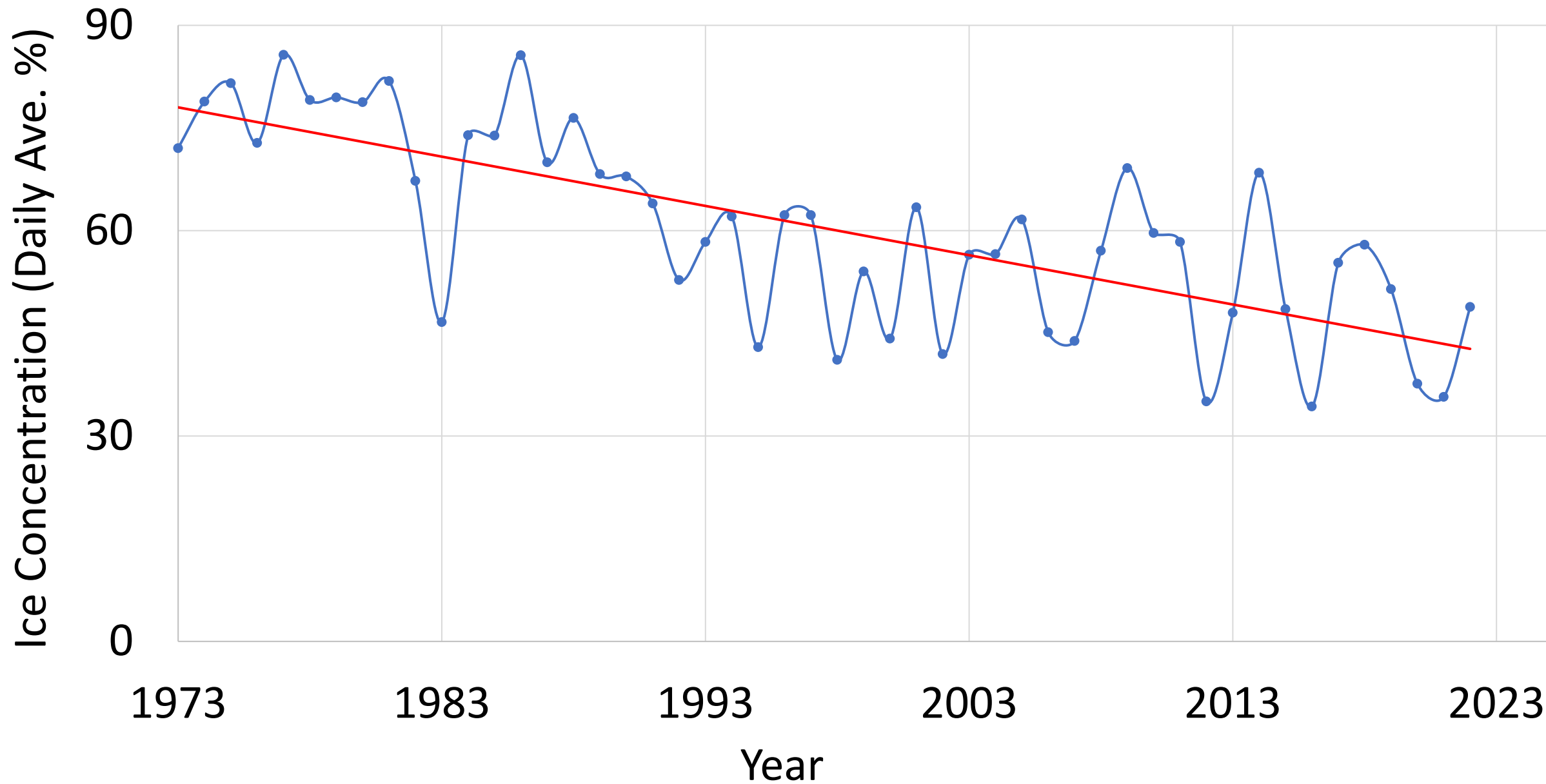
Change in Ice Cover Duration in the Great Lakes 1972 -2019



Lake Michigan Ice Cover

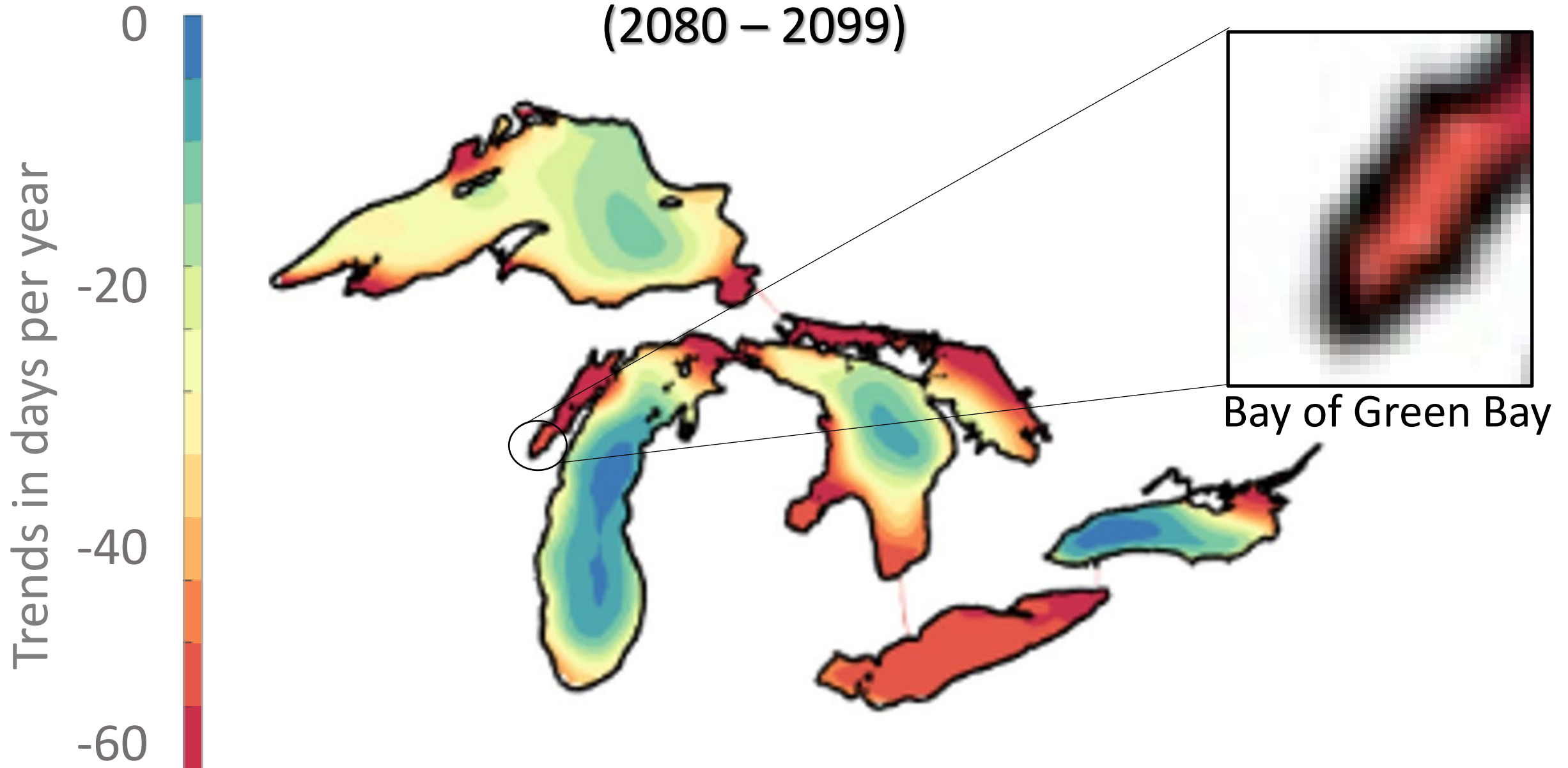


Green Bay: Percent of Ice Cover



Projected Change in Ice Cover Duration in the Great Lakes

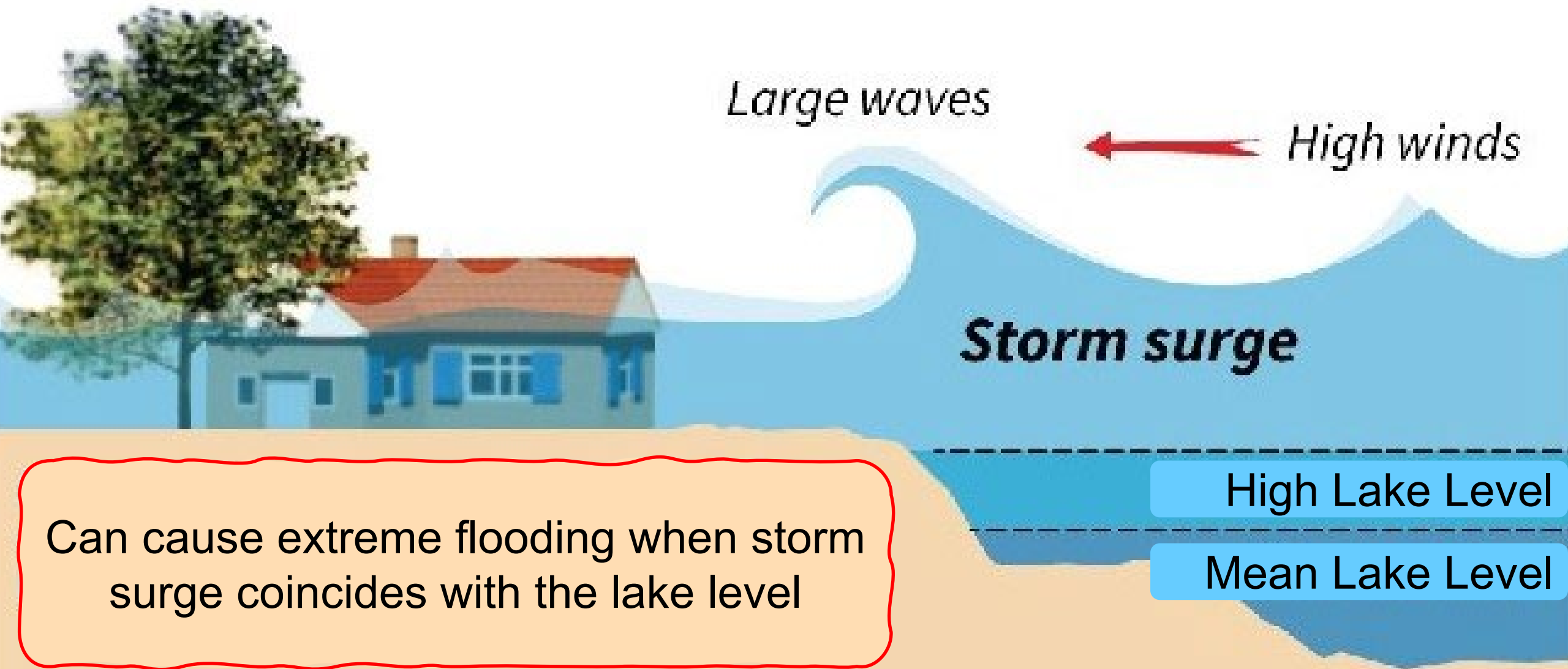
(2080 – 2099)





COASTAL FLOODING

April 8, 1973
Along the shore of Green Bay
3.3 foot storm surge



Large waves

High winds

Storm surge

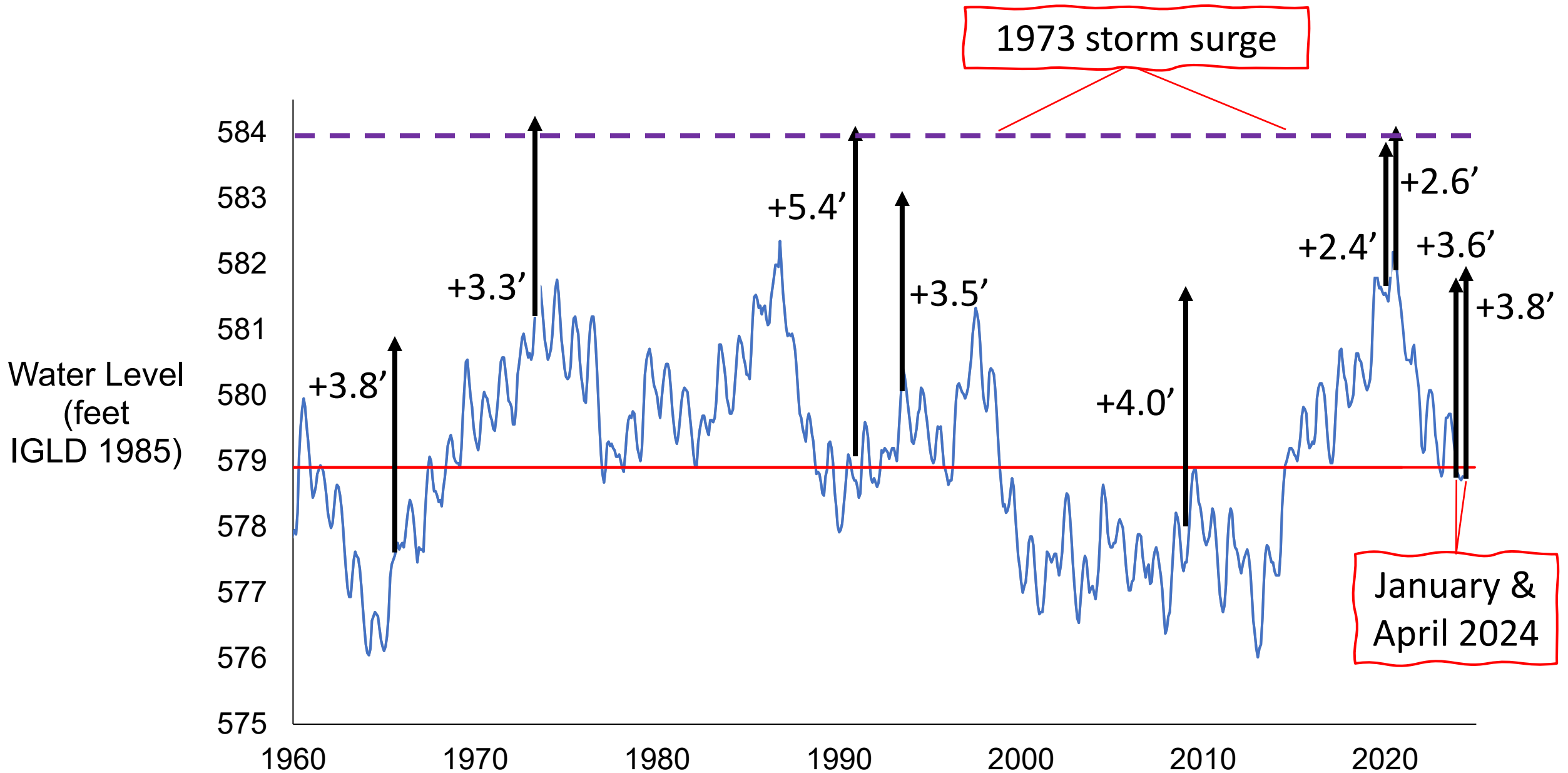
High Lake Level

Mean Lake Level

Can cause extreme flooding when storm surge coincides with the lake level

Buildings and roads damaged • Coastal erosion • Boats destroyed

Green Bay Water Levels + Storm Surge



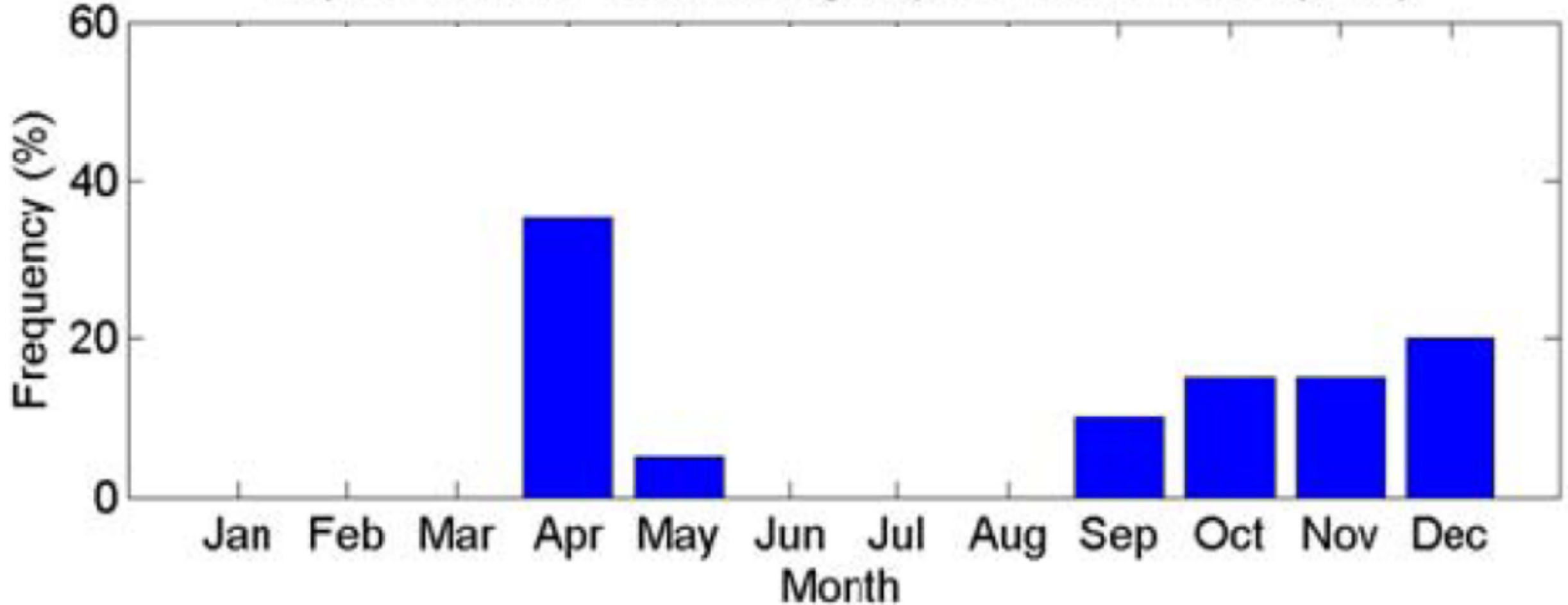


East Shore Drive
December 1, 2019 (+2.4-foot storm surge)

April 28, 2020 (+2.6-foot storm surge) Bay Beach Amusement Park



Top 20 Largest Storm Surges – Green Bay, WI

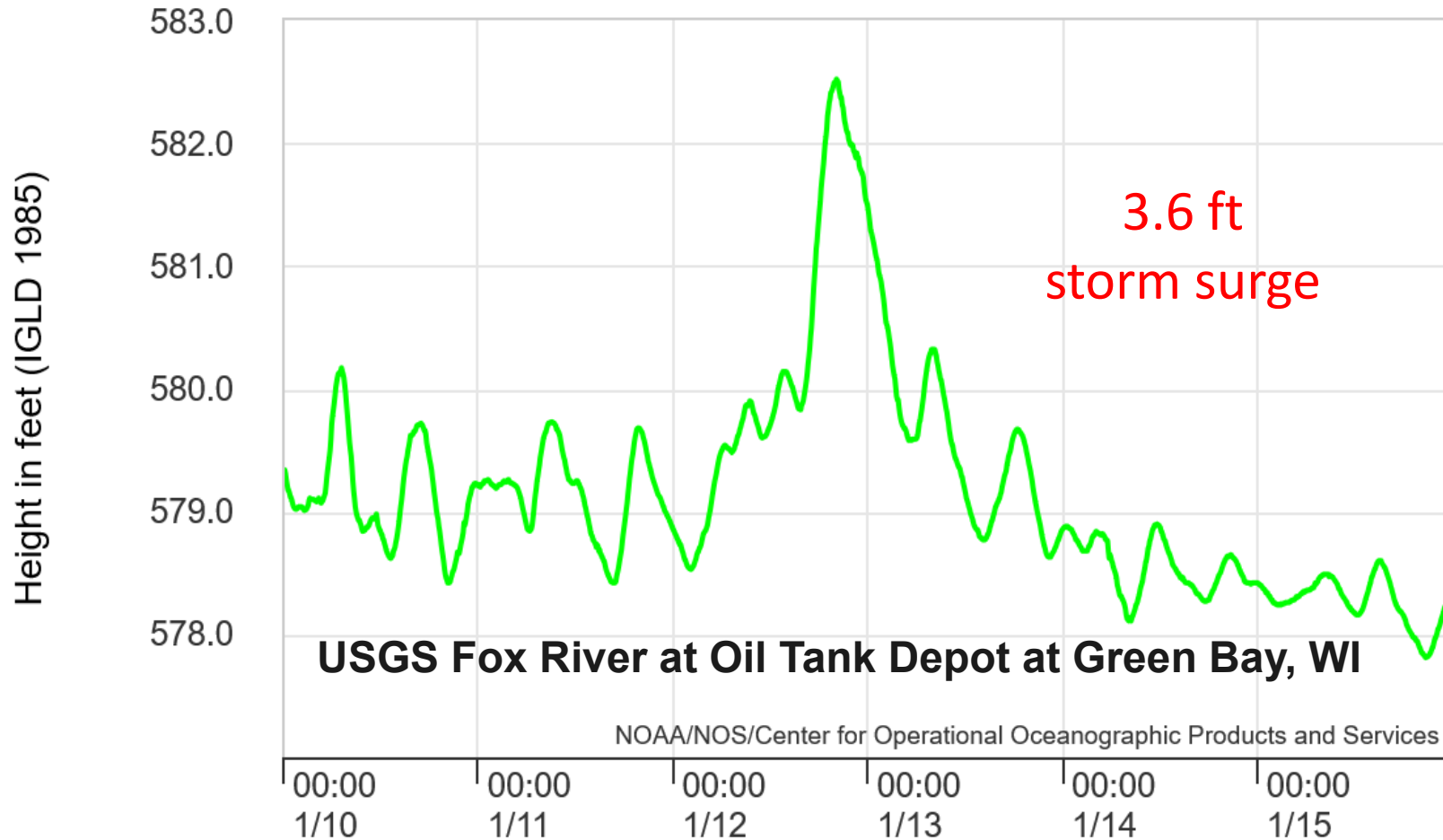


Why are there no large storm surges
January to March?

[USACE/Melby et al., 2012]

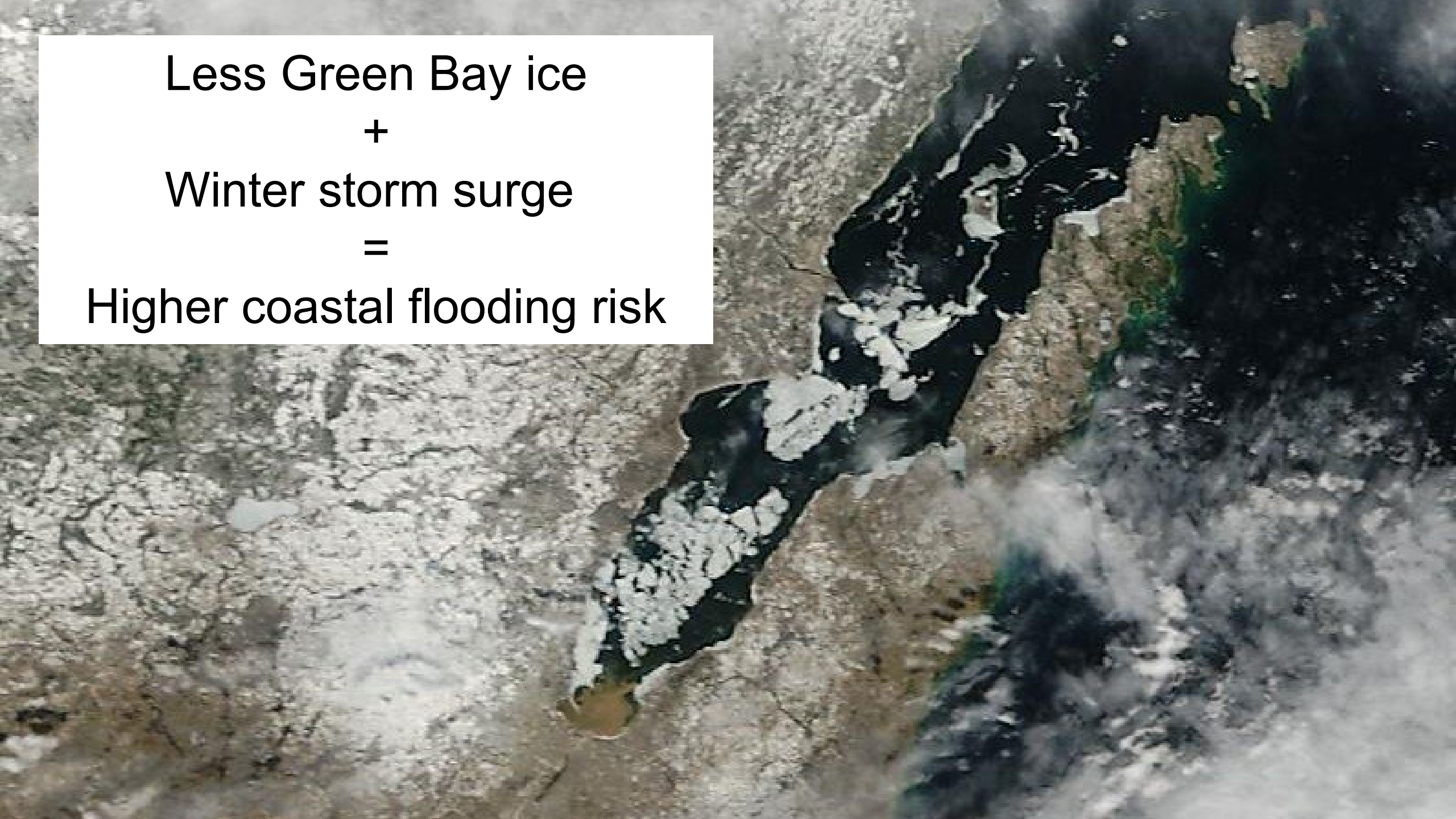
Then on January 12, 2024...

NOAA/NOS/CO-OPS
Observed Water Levels at 9087077, Green Bay East WI
From 2024/01/10 00:00 LST/LDT to 2024/01/15 23:59 LST/LDT



Would be a top 5 event

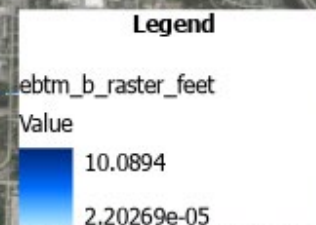
Less Green Bay ice
+
Winter storm surge
=
Higher coastal flooding risk



April 29, 2020
Flood Event
584.3 ft (IGLD 85)

Coastal Flood Vulnerability Analysis

Rebuilt dike added
to DEM at 586.5 ft
(IGLD 85)



Ground Truthing

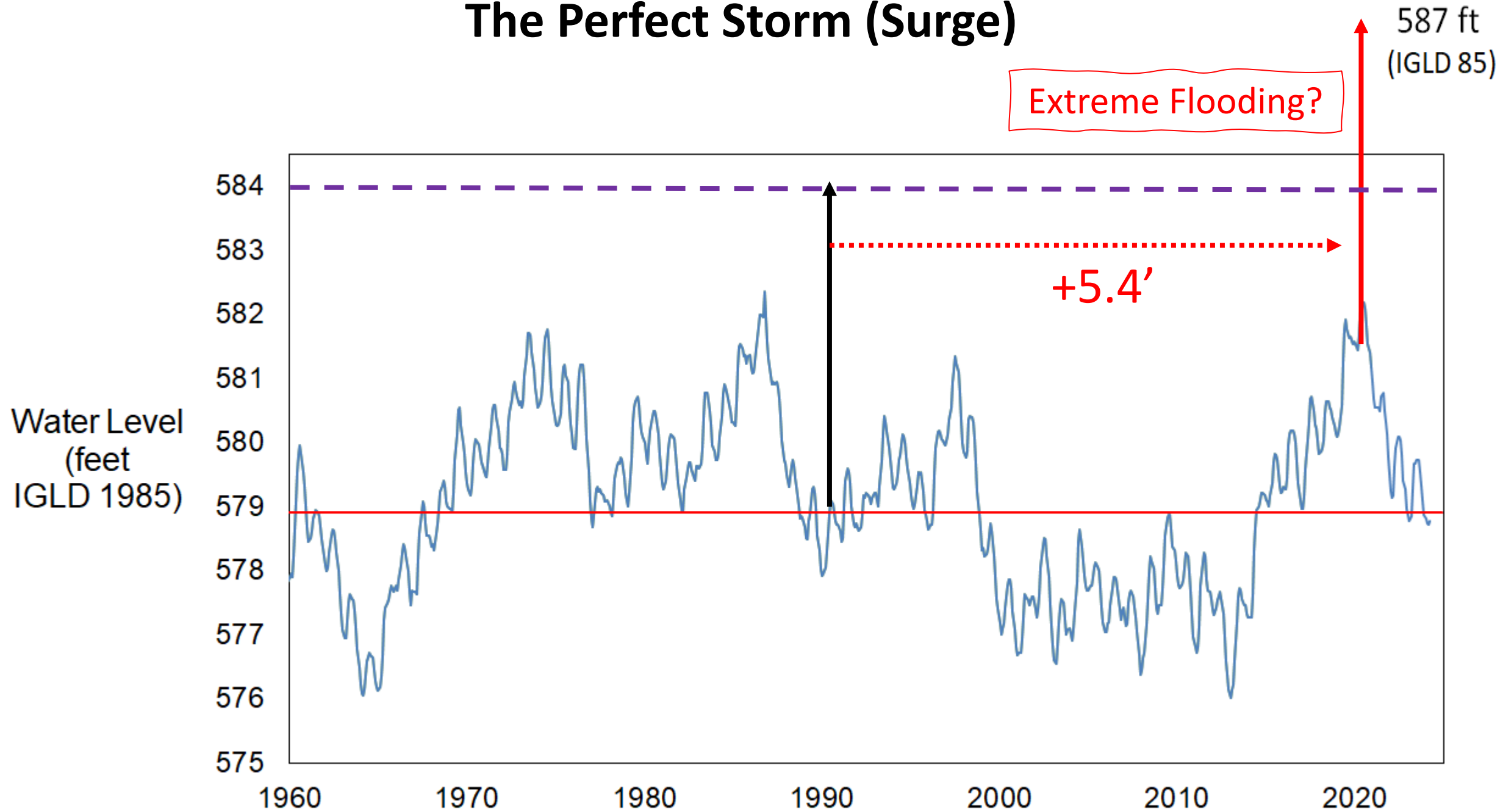


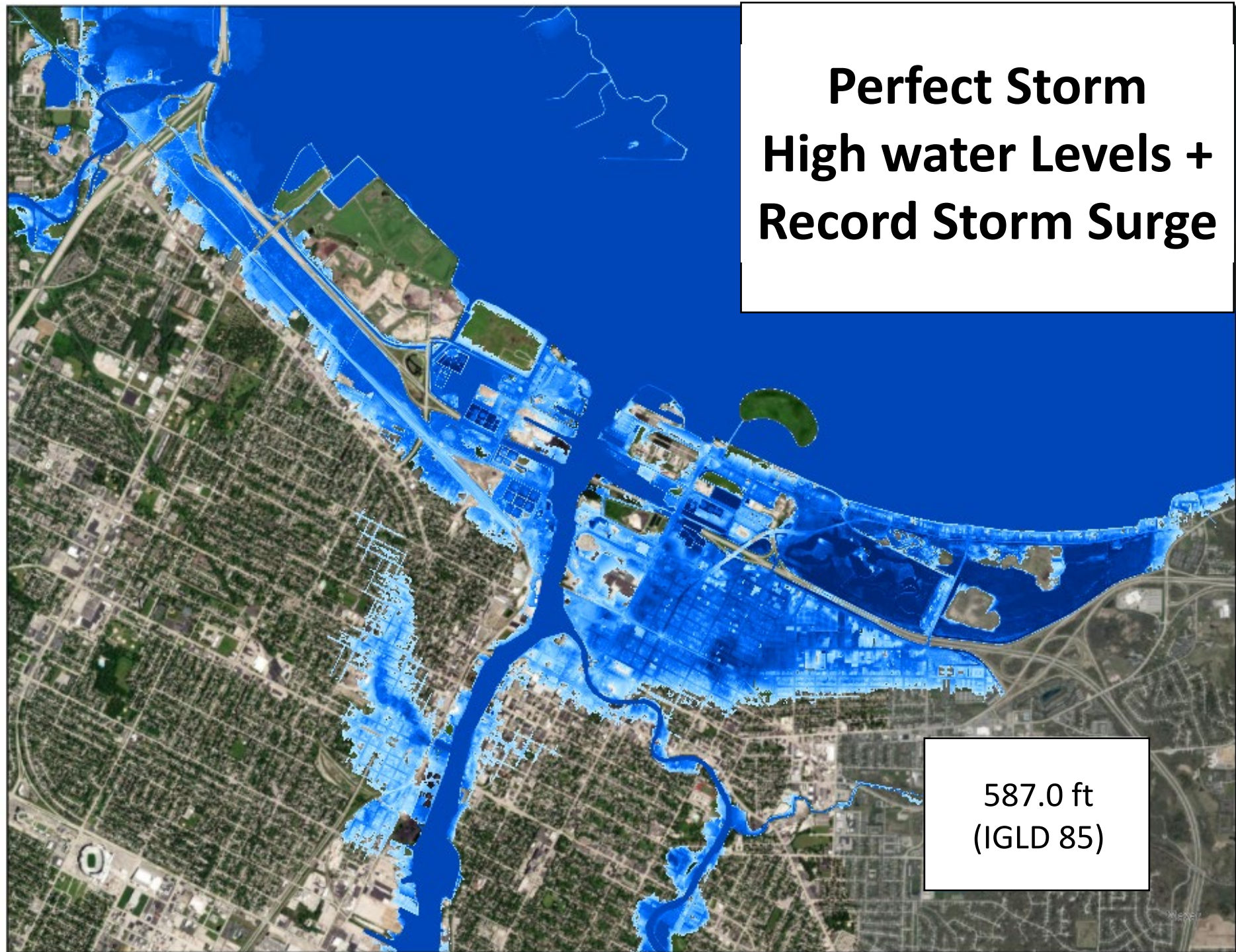
Ground Truthing

Model does not include
storm sewer system or waves



The Perfect Storm (Surge)



An aerial photograph of a coastal city, likely New York City, showing the Hudson River, East River, and surrounding urban areas. A large area of the city is overlaid with a blue color gradient, representing predicted inundation levels. The blue color is darkest in the areas closest to the water and fades to white in the inland areas. The inundation covers a significant portion of the city, including the Financial District, Midtown, and parts of the Bronx and Westchester County.

Perfect Storm High water Levels + Record Storm Surge

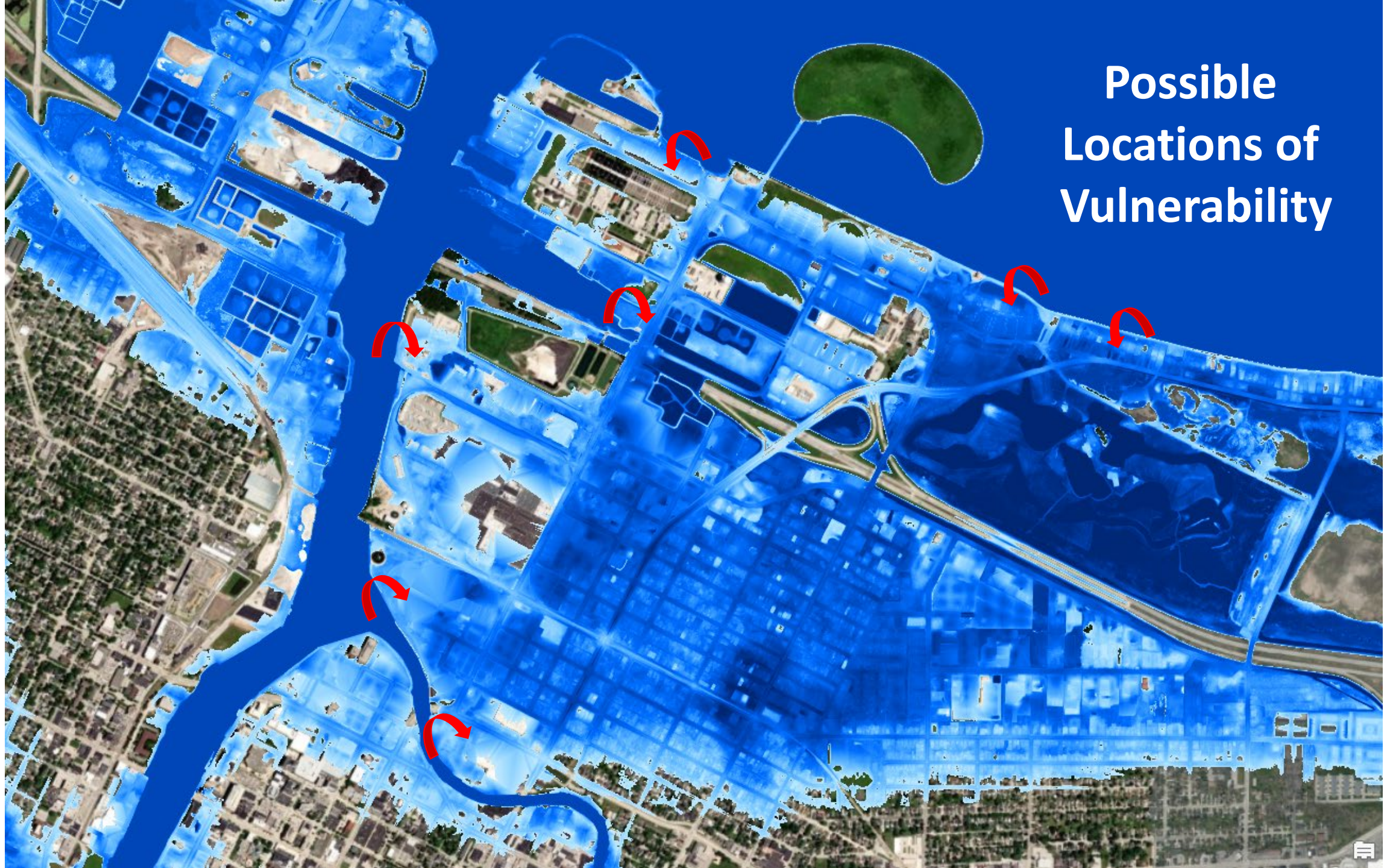
587.0 ft
(IGLD 85)

Legend

Feet of Inundation



Possible Locations of Vulnerability



In Summary



Photos: Green Bay Press-Gazette and others

Next Steps



Photo: Green Bay Press-Gazette

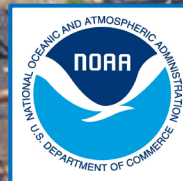
Climate Resilience Work Group

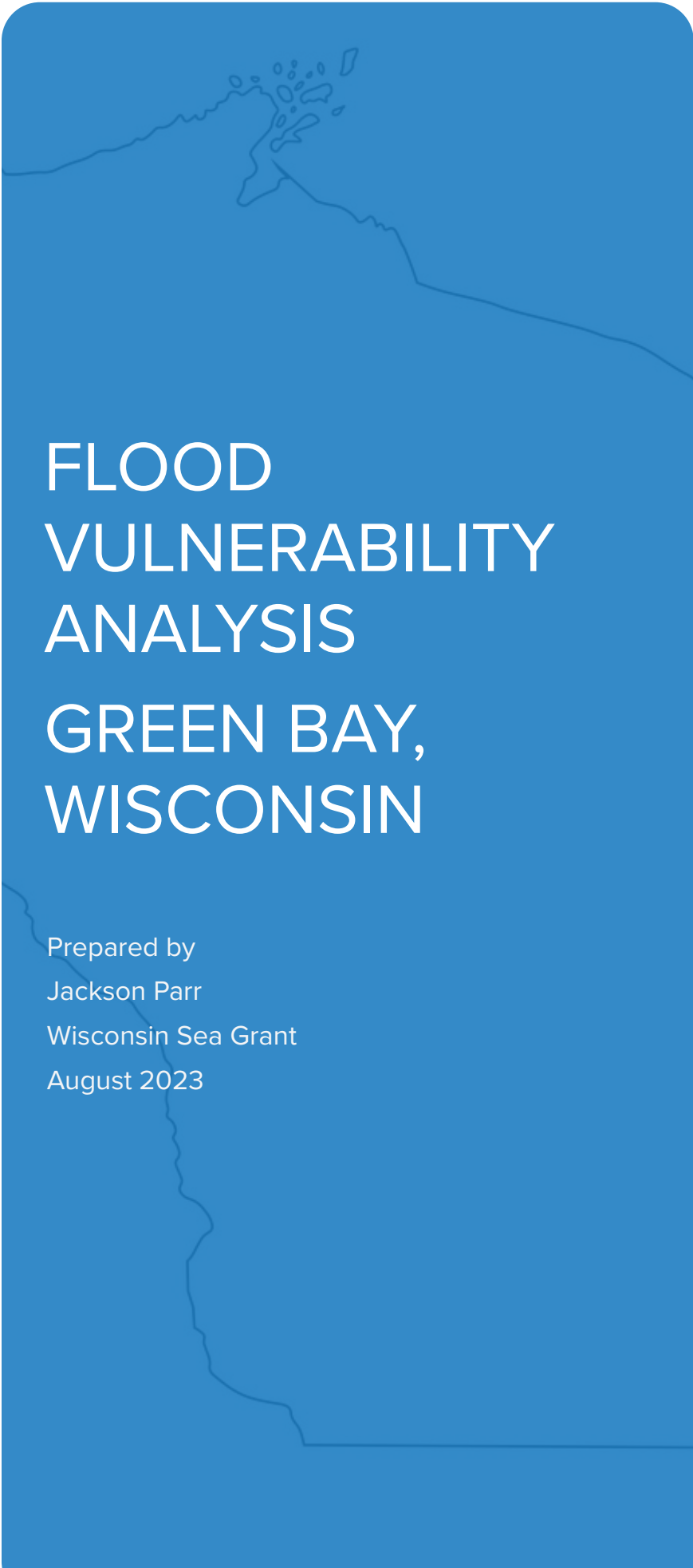
- 1) Examine social, economic and environmental impacts from climate hazards
- 2) Identify additional opportunities to increase resilience through greening and other nature-based solutions



An aerial photograph of a city, likely Milwaukee, Wisconsin, showing a river (Koshong River) flowing through the urban landscape. The city features a mix of industrial buildings, residential areas, and green spaces. In the background, a large body of water (Lake Michigan) is visible under a clear sky. A semi-transparent white rectangular box is overlaid on the center of the image, containing the text "Thank you!".

Thank you!





FLOOD VULNERABILITY ANALYSIS GREEN BAY, WISCONSIN

Prepared by
Jackson Parr
Wisconsin Sea Grant
August 2023

TABLE OF CONTENTS

Introduction	4
Project Area	4
Precipitation	6
Historic Precipitation	7
Rainfall Projections	9
Lake Level and Storm Surge	11
Considerations for Evaluating Rising Flood Vulnerability	13
Considerations for Winter Events	13
Flood Exposure Analysis	14
Social Vulnerability Analysis	18
Combined Social Vulnerability and Flood Exposure	22
Conclusion	24

GLOSSARY OF TERMS

Annual Exceedance Probability (AEP): The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Recurrence Interval (RI): The estimated average time between events based on the annual exceedance probability. For example, a 1% AEP would result in an estimated recurrence interval of 100 years.

Stochastic Storm Transposition: Resampling and random geospatial shifting (i.e. transposition) of observed storm events to generate hypothetical but realistic rainstorms (Wright et al. 2020).

Probabilistic Downscaling: A method to merge coarse resolution climate model simulations with historical local and regional rain gauge measurements to create statistical equations of the likelihood and amount of precipitation.

Wisconsin Sea Grant (WSG), Wisconsin Emergency Management (WEM), and the Bay Lake Regional Planning Commission (BLRPC) have partnered on a project funded by the National Sea Grant Office at the National Oceanic and Atmospheric Administration (NOAA) to build disaster preparedness capacity in northeast Wisconsin coastal cities.

Introduction

The frequency and severity of extreme rainfall events is projected to increase across Wisconsin and the Great Lakes region (Gronewold and Rood 2019; Winters et al. 2015). Additionally, Lake Michigan water levels are increasingly volatile and extreme, setting record highs and record lows within the past decade (USACE 2023). The combination of volatile lake levels and extreme rainfall will disproportionately impact coastal cities with river systems that empty into Lake Michigan. These frontline communities largely lack integrated coastal management planning (Norton et al. 2018), and many rely on external or regional partners for disaster preparedness planning.

Further, these coastal storm events and flooding have historically had a disproportionate impact on populations that are already marginalized and socially vulnerable (Tate et al. 2021; Donner & Rodriguez 2011). These populations, including racial minorities, low-income, elderly and youth, and others, carry greater burdens during the disaster response and recovery.

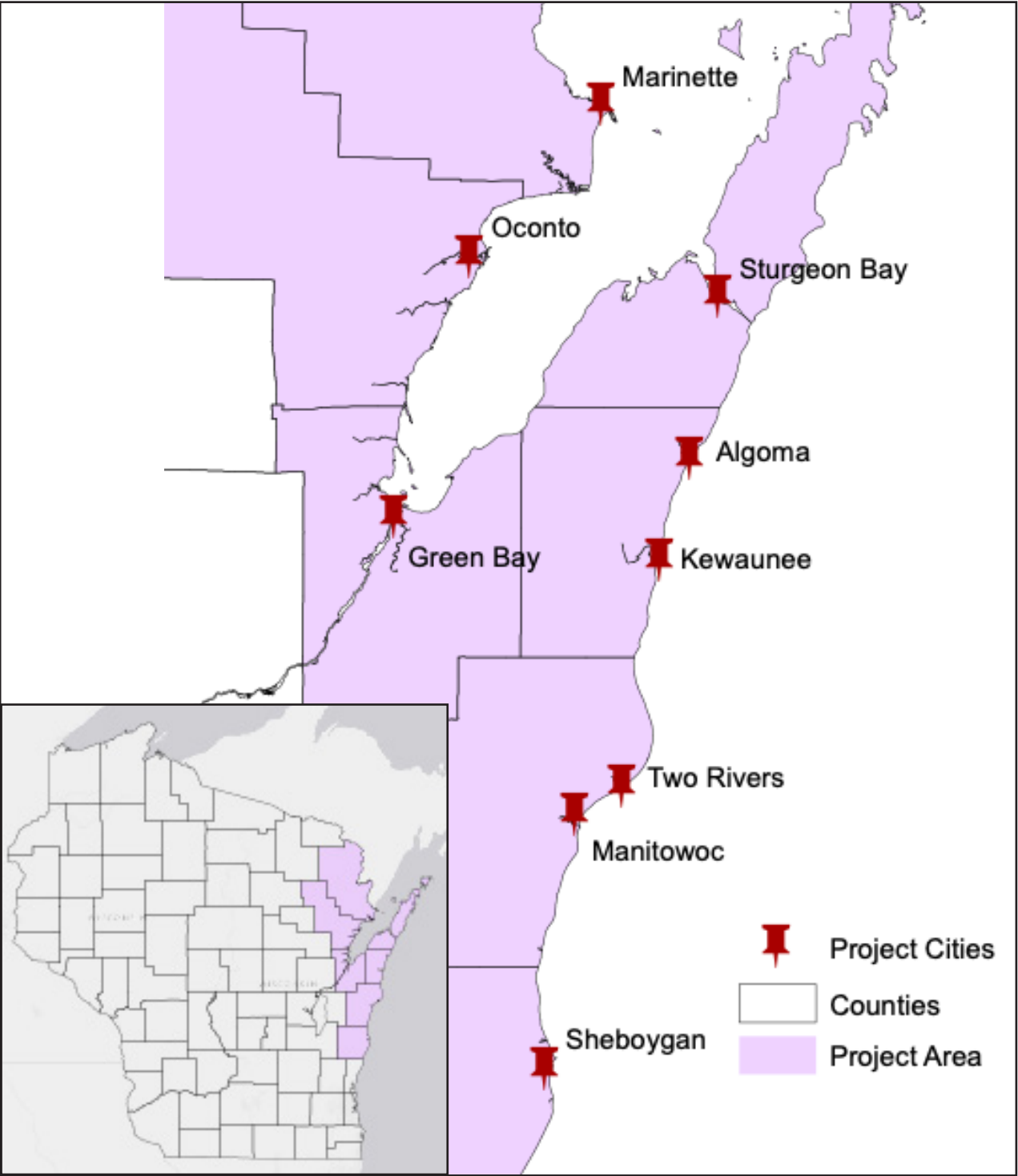
This project seeks to improve the disaster preparedness capacity of coastal cities in northeast Wisconsin through three phases:

- 1. **Producing a flood vulnerability analysis and report for each of the seven counties in the project area.** The report will review historic and projected precipitation, lake levels and storm surge, infrastructure expected to be affected by floodwaters during a given event, and social vulnerability. That analysis is contained in this report. These reports will be available at the [Wisconsin Coastal Atlas](#).
- 2. **Hosting a community flood preparedness event.** Working with local emergency managers, project staff will host events across the northeast Wisconsin region. Project staff will review the flood vulnerability analysis for local officials and residents, as well as host the Extreme Event Game – an interactive disaster preparedness game that builds community capacity for flood resilience.
- 3. **Assessing the integration of planning documents across northeast Wisconsin communities.** This phase will assess the extent to which planning documents in a municipality and county collectively promote resilience to flood disasters and provide recommendations on ways to improve resilience and preparedness across planning documents.

Project Area

This project is focused on nine coastal Lake Michigan cities across seven counties in northeast Wisconsin: Sheboygan, Manitowoc, Two Rivers, Kewaunee, Algoma, Sturgeon Bay, Green Bay, Oconto, and Marinette. These cities all fall within the service area of BLRPC and represent a variety of population sizes, government capacities, flooding histories, and coastal resilience challenges. Although this project will work closely with emergency management and other staff at the county level, city governments have significant responsibilities in terms of land use planning, floodplain regulation, emergency services and first responders, coastal management, and other policies and programs that contribute to disaster preparedness, response, recovery, and mitigation. The findings from the project and the capacity building activities can serve similar efforts in coastal Great Lakes cities. The project area is shown in Figure 1.

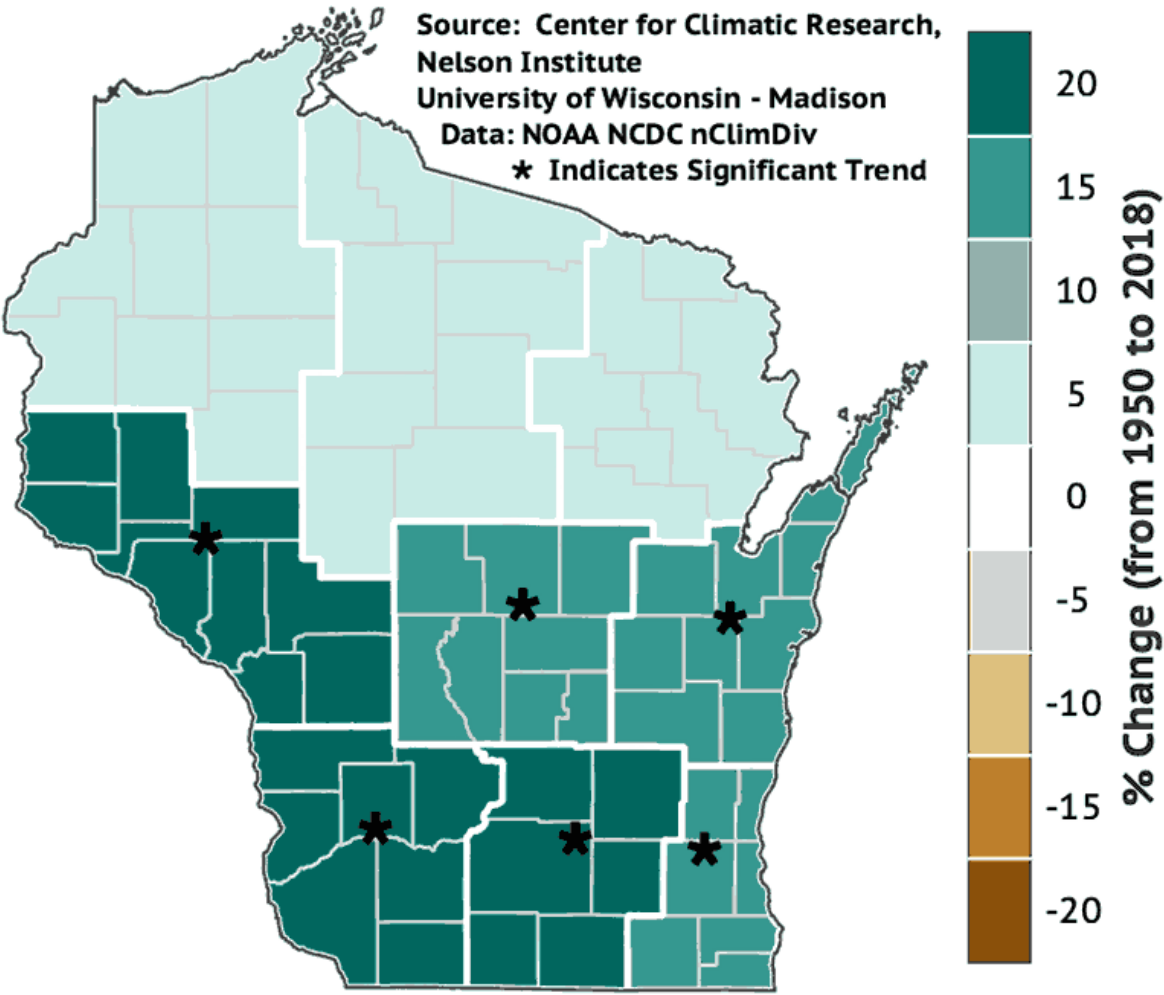
Figure 1. Project Area



Precipitation

Average annual rainfall in Wisconsin is approximately 30-34 inches, with northeast Wisconsin typically between 30-32 inches. The frequency and severity of rain events is increasing across the state. The Wisconsin Initiative on Climate Change Impacts (WICCI) determined that across Brown, Door, Kewaunee, Manitowoc, and Sheboygan counties, the average annual precipitation increased 15% from 1950 to 2018. Oconto and Marinette counties saw an increase in 5% over that period (Figure 2).

Figure 2. Historical percentage change in annual precipitation from 1950 to 2018



Source: Wisconsin Initiative on Climate Change Impacts (WICCI)

Severe rainfall events, where 2 or more inches of rain fall in a 24-hour period, are also increasing across Wisconsin. These high-intensity events are more likely to cause flooding, as the rate of precipitation exceeds the rate at which the water can infiltrate into soil. In more urbanized areas, the rapid accumulation of stormwater running off from impervious surfaces can exceed the capacity of stormwater infrastructure. These intense rain events are similarly increasing across Wisconsin. WICCI projections indicate that by the mid-21st century, much of the project area could see at least 2 more days per decade with more than 2 inches of rain, increasing from 8 to 10 days per decade.

The following sections provide a more detailed analysis of historic and projected precipitation in Green Bay.

Historic Precipitation

- The number of severe rainfall events (over 2” in 24 hours) in Green Bay has been increasing, especially since 2010.
- The largest rainfall recorded in a single day in Green Bay was 4.9 inches, which occurred on June 22, 1990 and is associated with a 50- to 100-year rain event.

Methodology

Data on historic precipitation was taken from NOAA’s National Centers for Environmental Information website, specifically the Global Historical Climatology Network (GHCN) – Daily, Version 3. A preference was given to rain gauges with a long historical record, followed by their proximity to the city. A table of the rain gauges used for each city is provided below. The daily precipitation amounts were converted to inches and sorted by precipitation amount. The precipitation amount and associated date were consolidated by year to demonstrate the annual frequency of rainfall events greater than 2 inches, as well as a review of associated media coverage that informs this section.

Table 1. List of Repsective Rain Gauges Used

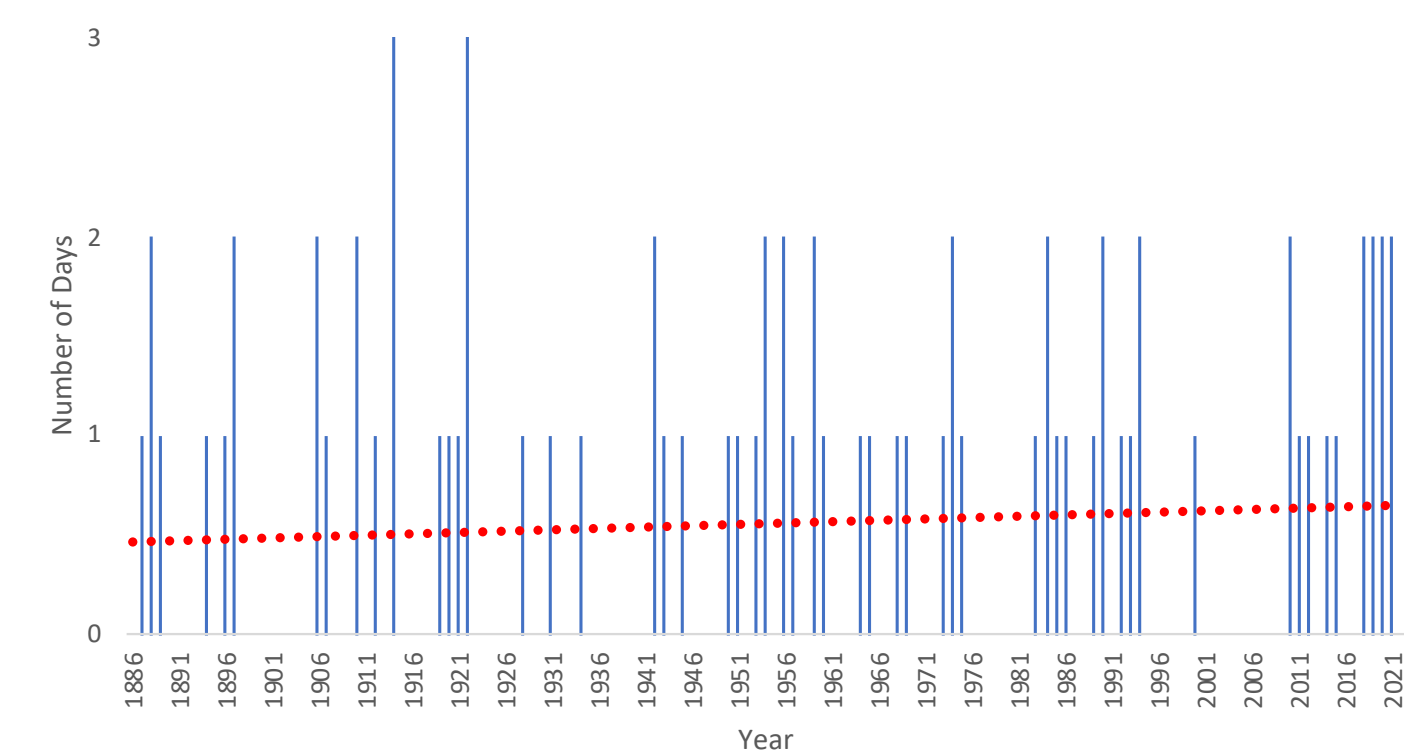
City	County	Station	Period of Record
Kewaunee	Kewaunee	USC00474195	1908-12-01 to Present
Algoma	Kewaunee	USC00474195	1908-12-01 to Present
Sheboygan	Sheboygan	USC00477725	1899-09-01 to 2008-08-31
	Sheboygan	USC00471605	2008-09-01 to Present
Two Rivers	Manitowoc	USC00478672	1950-10-05 to Present
Manitowoc	Manitowoc	USC00475017	1893-01-01 to Present
Sturgeon Bay	Door	USC00478267	1905-03-01 to Present
Green Bay	Brown	USW00014898	1886-09-01 to Present
Oconto	Oconto	USC00476208	1893-01-01 to Present
Marinette	Marinette	USC00475091	1919-02-01 to Present

There are some limitations in this analysis. First, the 24-hour time scale may fail to capture both high-intensity and short duration (less than 24-hour) rain events, as well as cumulative precipitation over a long time period that cause saturation and subsequent flooding. Additionally, the GHCN data is limited by the application and long-term maintenance of rain gauges. Some cities in the project area did not have a long-term rain gauge within city limits, which may misrepresent the actual precipitation within that city. Further, the rain gauges may be missing data for some of the days since they were deployed.

Results

The number of rainfall events each year that exceeded 2 inches during a 24-hour period for the Green Bay rain gauge listed above is provided in Figure 3. Two-inches of rain in a 24-hour period is a heavy rain event that typically occurs at once per year (on average). Figure 3 shows some variability in the frequency on 2-inch rain events, but there has been a notable increase the frequency of these events since 2010. In four years from 2018 to 2021, there were 8 rain events exceeding 2 inches in 24 hours, or twice as many as would be estimated. This increasing frequency is demonstrated by the linear trendline in red, which shows an upward trend in the frequency of 2-inch rain events at the rain gauge in Green Bay.

Figure 3. Number of Days Exceeding 2-inch Rainfall



Equally important is the frequency of severe rain events, or those of greater than 2.0 inches of rain in 24 hours (the approximate 100-year rain event in Green Bay). Table 2 lists the ten largest rainfall events within the period of record for the Green Bay rain gauge. The most extreme rainfall event of 4.9 inches occurred on June 22, 1990. According to precipitation estimates, a rainfall event of this magnitude should only occur once every 50 to 100 years. Precipitation estimates in Green Bay historically align with expected precipitation from NOAA’s Atlas 14. However, the marked increase in relatively severe events (approximately 2-inch events) in the past decade suggest Atlas 14 estimates may now be outdated. Precipitation estimates from NOAA’s Atlas 14 are highly integrated into many local, state, and federal policies including floodplain delineation and flood insurance mandates, bridge construction, and stormwater systems. Therefore, underestimating precipitation can have implications for these policies.

Table 2. List of Most Severe Rainfall Events in Green Bay

Date	Precipitation (Inches)
June 22, 1990	4.90
July 23, 1912	4.39
July 8, 2000	4.12
August 28, 1975	3.83
June 10, 1922	3.70
June 3, 1914	3.61
September 16, 1888	3.56
June 18, 1928	3.49
October 2, 1954	3.44
June 17, 1984	3.43

Rainfall Projections

- Rainfall statistics known as Atlas 14 that are used in many designs, regulations and policies underpredict the actual severe rainfall event risk.
- The commonly used 1% chance rainfall event of 5.4” in 24 hours in Green Bay (source: Atlas 14) is estimated to occur more frequently (~1.5% chance) using updated statistics.

Atlas 14 is the official record of precipitation frequency estimates for the United States produced by the National Weather Service (NWS) Office of Water Prediction, which is part of the National Oceanic and Atmospheric Administration (NOAA). Atlas 14 details the probability that a certain amount of rain will fall in a given time period (5 minutes to 60 days). Rainfall statistics are often expressed as Annual Exceedance Probability (AEP), the probability that a rainfall of a certain amount and duration will occur or being exceeded in a given year (on average). This probability is also commonly expressed as a recurrence interval, which is the probabilistic average amount of time between events in years. For example, a rainfall event with a 1% AEP (or 1 in 100 chance) may also be referred to as having a 100-year recurrence interval. The recurrence interval does not mean an event will only happen at this interval, but is rather a shorthand way of expressing probability in a commonly understood unit of years. As an example, Atlas 14 says that if 5.4 inches of rain fell on Green Bay in a 24-hour period, that’s a 1% or “100-year” rain event. These estimates are highly integrated into infrastructure design, floodplain and watershed management, and other urban planning and natural resource management applications.

The most recent available data for Wisconsin is Volume 8, Version 2 of Atlas 14, which incorporates precipitation data through 2012 (Perica et al. 2013). Although this represents a significant portion of the historic rainfall record, Atlas 14 does not include data from the past 10 years. Given that the past decade has seen the increasing frequency and severity of rain events across Wisconsin, Atlas 14 may not be capturing the true story of rainfall in Wisconsin today.

The Wisconsin Rainfall Project seeks to incorporate more recent rainfall data into precipitation estimates, as well as project precipitation estimates under future climate scenarios. First, the Wisconsin Rainfall Project uses the University of Wisconsin’s RainyDay software to update Atlas 14 estimates with present day precipitation data. RainyDay uses stochastic storm transposition, which involves resampling and random transposition of past storm events to generate hypothetical but realistic rainstorms (Wright et al. 2020). RainyDay has demonstrated that across much of the state and the project area, Atlas 14 underestimates extreme precipitation. In other words, what Atlas 14 calls a 1% rain event is more probably than 1 in 100. The comparison between Atlas 14 and RainyDay for your specific county is provided below.

Future projections of extreme rainfall under various climate scenarios were also completed as part of the Wisconsin Rainfall Project. The method uses University of Wisconsin Probabilistic Downscaling (UWPD) to capture local scale rainfall patterns by merging global climate models with local and regional rain gauge data. This provides precipitation estimates for the 100-year, 24-hour rain event under both a low emissions and high emissions scenario projecting over 100 years from 2000 to 2100. The projected precipitation estimates for your county are provided in the analysis below.

Methodology

Data was downloaded from the Wisconsin Rainfall Project website for each of the seven project area counties. The data included estimates in inches for a 24-hour rainfall from Atlas 14, RainyDay, and the 2041-2070 High Emissions Scenario for recurrence intervals from 1 to 1000 years. Linear interpolation was used to re-estimate the recurrence interval of Atlas 14 precipitation amounts using precipitation estimates from both RainyDay and the High Emissions Scenario. The same linear interpolation method was used to determine the annual chance probability of a given rainfall amount.

Results

Table 3 shows the estimated recurrence interval for a given rainfall amount in Brown County. The rainfall amounts in the first column are the Atlas 14 rainfall estimates associated with common recurrence intervals. The Present Day column shows the estimated recurrence interval for a given rainfall amount using the Wisconsin Rainfall Project’s RainyDay program. The last column, Mid-Century, is the estimated recurrence interval for a given rainfall amount using the High Emissions Scenario of the Wisconsin Rainfall Project.

In Table 3, for the row detailing a 5.4-inch rainfall, Atlas 14 estimates a 100-year recurrence interval, or 1% AEP. Using updated rainfall data, that same 5.4-inch rainfall is expected to occur at a 65-year recurrence interval. Future projections under a high emissions scenario anticipate a 5.4-inch rainfall to occur at a 39-year recurrence interval.

The right side of Table 3 presents the same information through the AEP. Under both the Present Day and Mid-Century columns, the higher estimated probabilities compared to the Atlas 14 AEP’s suggest a greater frequency of more intense rain events. For example, a 10% AEP rain event has a 12.5% AEP under Present Day estimates and a 20% AEP under Mid-Century estimates. Across both tables, Present Day and Mid-Century estimates indicate that a given severe rain event is expected to occur more frequently than is currently estimated by Atlas 14.

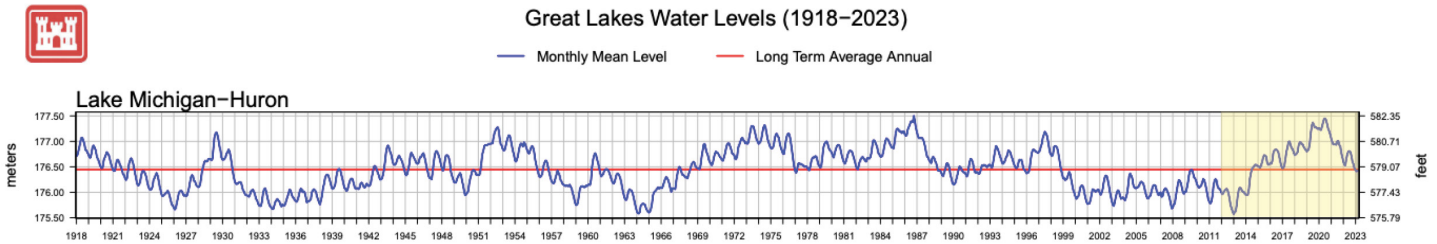
Table 3. Estimated Recurrence Intervals and AEP using the Wisconsin Rainfall Project (for Brown County)

Rainfall Amount (inches)	Recurrence Interval (year)			Annual Exceedance Probability (AEP)		
	Atlas 14 (1896-2010)	Present Day (2002-2019)	Mid-Century (2041-2070)	Atlas 14 (1896-2010)	Present Day (2002-2019)	Mid-Century (2041-2070)
2.1	1	X	X	100.0%	X	X
2.4	2	2	X	50.0%	X	X
2.9	5	4	3	20.0%	25%	33.3%
3.4	10	8	5	10.0%	12.5%	20%
4.2	25	19	11	4.0%	5.3%	9.0%
4.8	50	35	21	2.0%	2.9%	4.8%
5.4	100	65	39	1.0%	1.5%	2.6%
6.2	200	120	74	0.5%	0.8%	1.4%
7.2	500	293	169	0.2%	0.3%	0.6%
8.0	1000	490	343	0.1%	0.2%	0.3%

Lake Level and Storm Surge

Water levels in the Great Lakes are expected to become more volatile in the future, with potentially higher highs and lower lows. Recent highs occurred in 2020, when readings on Lake Michigan recorded 582.4 feet (IGLD 1985). Record lows of 576.0ft occurred in 2013, just seven years earlier. Climate impacts on precipitation, evaporation, winter lake ice, and runoff in the Great Lakes basin are projected to exacerbate these extremes (MacKay and Seglenicks 2013; Music et al. 2015; Notaro et al. 2015; Mailhot et al. 2019). Figure 4 shows the long-term water levels on the Great Lakes, with the recent period of record water levels highlighted in yellow. Both high and low water level extremes should be anticipated under a changing climate, with the potential for higher highs and lower lows than seen in the historical record (Notaro et al. 2015).

Figure 4. Long-term Lake Levels of Lake Michigan-Huron

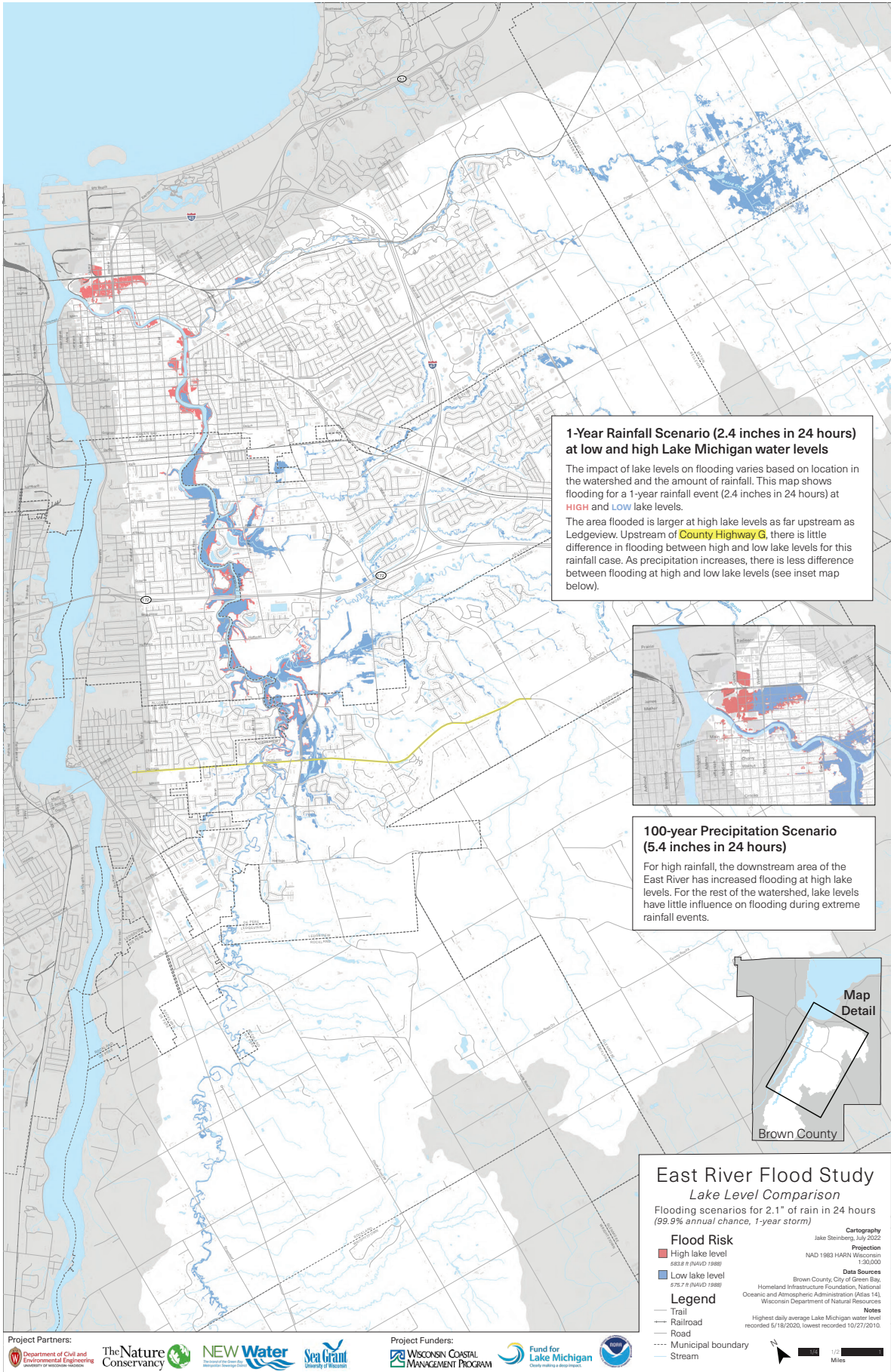


High lake levels contribute to coastal flooding by encroaching further up the shoreline and overtopping flood control structures. With higher water levels, deeper water near the shore also allows greater wave action and storm surge to reach the shore. The Federal Emergency Management Agency (FEMA) is currently developing the Great Lakes Coastal Flood Study, which includes a comprehensive analysis of storm and high-water events, including wave hazards, in the Great Lakes. These analyses have demonstrated the extent to which storm surge and waves can run further inland from the shoreline. For example, a 1% annual chance storm can add 4 to 6 feet to record high water levels across much of the northeast Wisconsin shoreline due to storm surge, wave action and runup, according to shoreline transect data in FEMA’s Flood Insurance Studies. These effects are being incorporated into updated FEMA flood maps along the entire Great Lakes coast over the next several years.

Combined Lake Level and Riverine Flooding

High lake levels can also compound flooding during rain events, causing flooding both at the river mouth and upstream (Saharia et al. 2021; Moftakhari et al. 2017). In Green Bay’s East River, a modeling study examined how flooding due to heavy rainfall events increased at high lake levels compared with the same rainfall at low lake levels. (East River Collaborative, 2023). The impact of lake levels on flooding varied based on location in the watershed and the amount of rainfall. The influence of lake levels on flooding is greatest near the mouth of the East River and decreases further upstream. In terms of precipitation, lake levels have a greater impact on flooding during lower precipitation events, such as the 1-year rainfall. The effect of lake level on flooding was less pronounced at the most extreme rainfall amounts (100-year and 500-year rainfall). At these high precipitation amounts, only the area near the mouth of the East River has increased flooding at high lake levels.

Figure 5. East River Flood Study: Lake Level Comparison



Considerations for Evaluating Rising Flood Vulnerability

All nine cities in this project have a river feature with its outlet into Lake Michigan or Green Bay. Although the true effect of high lake levels on upstream flooding varies by river, it is likely that high lake levels do affect the upstream floodplain across all nine cities in this project area. The effect is likely greater for cities with low-lying areas, such as Green Bay, Oconto, and Marinette.

The rainfall analysis in this report demonstrated the increasing frequency and severity of rain events throughout northeast Wisconsin, both at present day and in the future. Meanwhile, water levels on Lake Michigan are becoming increasingly volatile, with the potential for new record highs in the future. The compound effects of high lake levels expanding the upstream floodplain during extreme rain suggests the current 100-year floodplain is, or will soon be, underestimating the true extent of flooding in an area. One way to address this probable increase in the floodplain during future combined high lake level and extreme rain events would be to consider larger flood events in flood analysis. This approach will be used in the Flood Exposure Analysis below by using FEMA's 500-year floodplain for portions of the analysis.

Consider flooding beyond the present FEMA 100-year floodplain to prepare for the likelihood of increased frequency and severity of flooding.

Considerations for Winter Events

County Emergency Managers in the project area cited flooding in winter months due to snowmelt, ice jams, and rainfall as a significant, but often overlooked, concern. In March 2019, a combination of near-record high water levels on Lake Michigan, storm surge, rainfall on frozen ground, and rapid snowmelt caused widespread flooding of near-freezing water in the City of Green Bay, prompting approximately 80 to 100 evacuations and 37 condemned homes (WEM Incident Report 2019). In March 2020, ice jams along the East River and Duck Creek in Brown County prompted flood concerns.

Ice jams, which cause flooding due to the accumulation of ice in a river that blocks the flow of water, are rarely mapped like Flood Insurance Rate Maps. Ice jams are also hard to predict, as they can occur with little to no precipitation. For example, in the two days leading up to the March 2020 ice jam in Brown County, precipitation was negligible. However, the ice jams and high lake levels led to flooding that was much more severe than this rainfall amount typically would at non-freezing or low lake level conditions.

Winter flooding also creates unique challenges for emergency response. Common health impacts of flooding, such as hypothermia, are made more severe due to the cold weather and water. First responders may require special equipment to access homes or conduct rescues. This equipment can be cost-prohibitive for small, rural, or under-resourced communities.

Flood Exposure Analysis

- 25.3% of parcels in Green Bay intersect with the FEMA 500-year floodplain
- 9.4% of road miles in Green Bay intersect with the FEMA 500-year floodplain
- The highest levels of flood exposure occur along the East River, particularly where the East River meets the Fox River.

Flood exposure consists of the human resources and built environment within a floodplain (Koks et al. 2015; Tate et. al. 2021). Areas with higher levels of flood exposure incur greater impacts to the people and structures during a flood event. The primary source for flood exposure information is the Flood Insurance Rate Maps (FIRM) developed by FEMA, which are used for this analysis. FIRMs primarily represent riverine flooding and coastal flooding, where water overflows from a river or coastal waterbody. FEMA FIRMs map the extent of flooding at a 1% AEP (commonly called the 100-year floodplain) and 0.2% AEP (commonly called the 500-year floodplain). However, an important limitation to the FEMA maps is the underrepresentation of pluvial flooding, which occurs when extreme rainfall causes flooding independent from an overflowing water body. This could include overwhelmed drainage infrastructure or flash flooding. Still, FEMA FIRM maps provide a useful and universal representation of flood exposure. The FEMA 100-year floodplain is a commonly referenced indicator of a property’s flood risk (at the 1% AEP). Documented increases in the frequency of extreme precipitation suggest that the likelihood of a rainfall event that could cause this level of flooding is likely greater than the 1% AEP. For this reason, both the 100-year and 500-year FEMA FIRM floodplains are used to represent flood risk in this analysis to provide a more representative measure of flood risk in the present and into the future.

Figure 6 shows a map of all the parcels in the City of Green Bay that intersect with the combined FEMA 100- and 500-year floodplain. Any parcel that is either fully or partially within the floodplains is highlighted in red. Across the census block groups that constitute the City of Green Bay, 25.3% of parcels intersect with the FEMA 500-year floodplain. The city’s flood-prone parcels are along the coastal area, the Fox River corridor, and the East River and its tributaries. Figure 7 is a similar map that depicts the intersection of the floodplain with roads. The roads colored red are likely to be inundated by or overlaying floodwaters during a 500-year flood event Across the census block groups that constitute the City of Green Bay, 9.4% of road miles intersect with the FEMA 500-year floodplain. Inundated roads are particularly important to consider for first responders during flood events, as they may affect travel times or ingress and egress from parts of the city.

Flood Exposure Index Methodology

For this analysis, delineations in the FEMA flood hazard maps have been aggregated to the census block group level to better align with the social vulnerability analysis provided later in this report. Due to the probable increase in the floodplain during future combined high lake level and extreme rain events, this analysis uses both the 100- and 500-year floodplain from FEMA’s flood hazard maps for this analysis. Additionally, to capture the pluvial flood exposure that is generally missing from FEMA’s flood hazard maps, additional data on density of development and soil type is used to represent areas of high runoff potential that may be more likely to flood due to extreme rain overwhelming drainage infrastructure. A table of the indicators used in the flood exposure analysis is provided in Table 4.

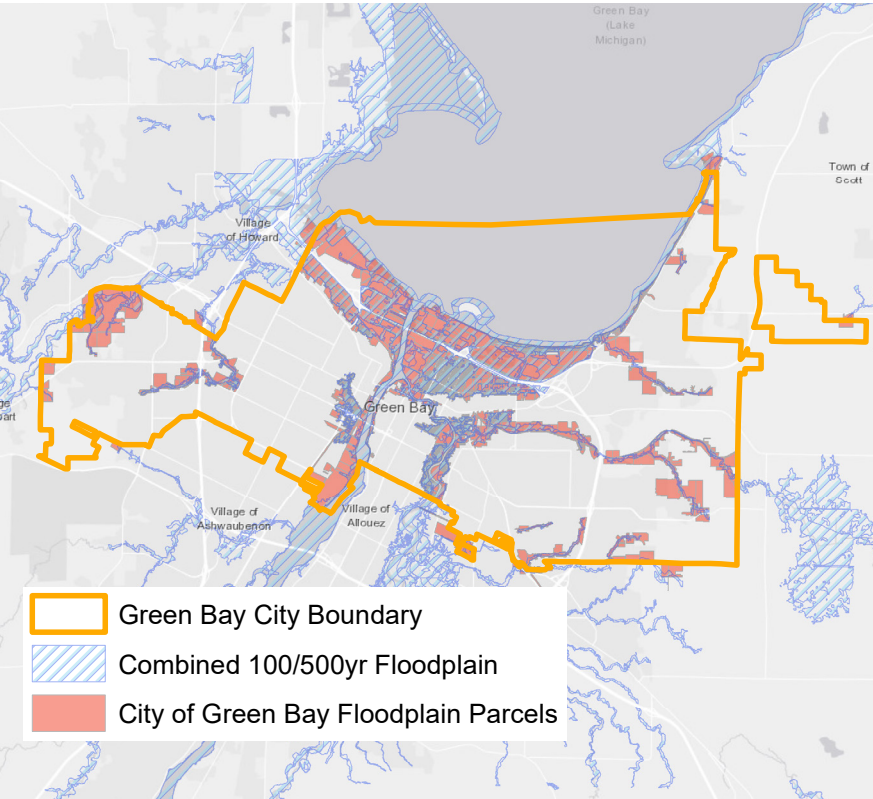


Figure 6. Map of parcels that intersect with the combined 100- and 500-year floodplain.

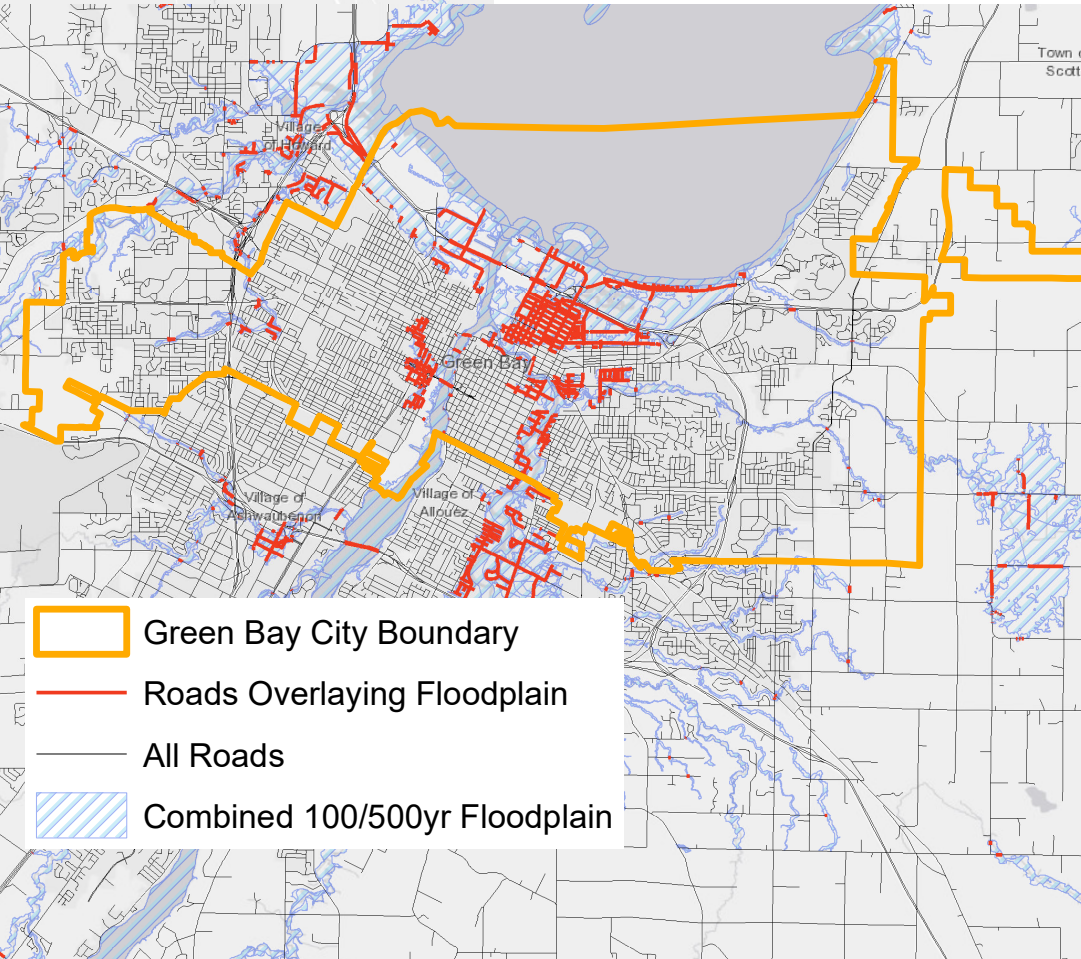


Figure 7. Map of roads that intersect with the combined 100- and 500-year floodplain.

Table 4. Indicators Used for the Flood Exposure Analysis

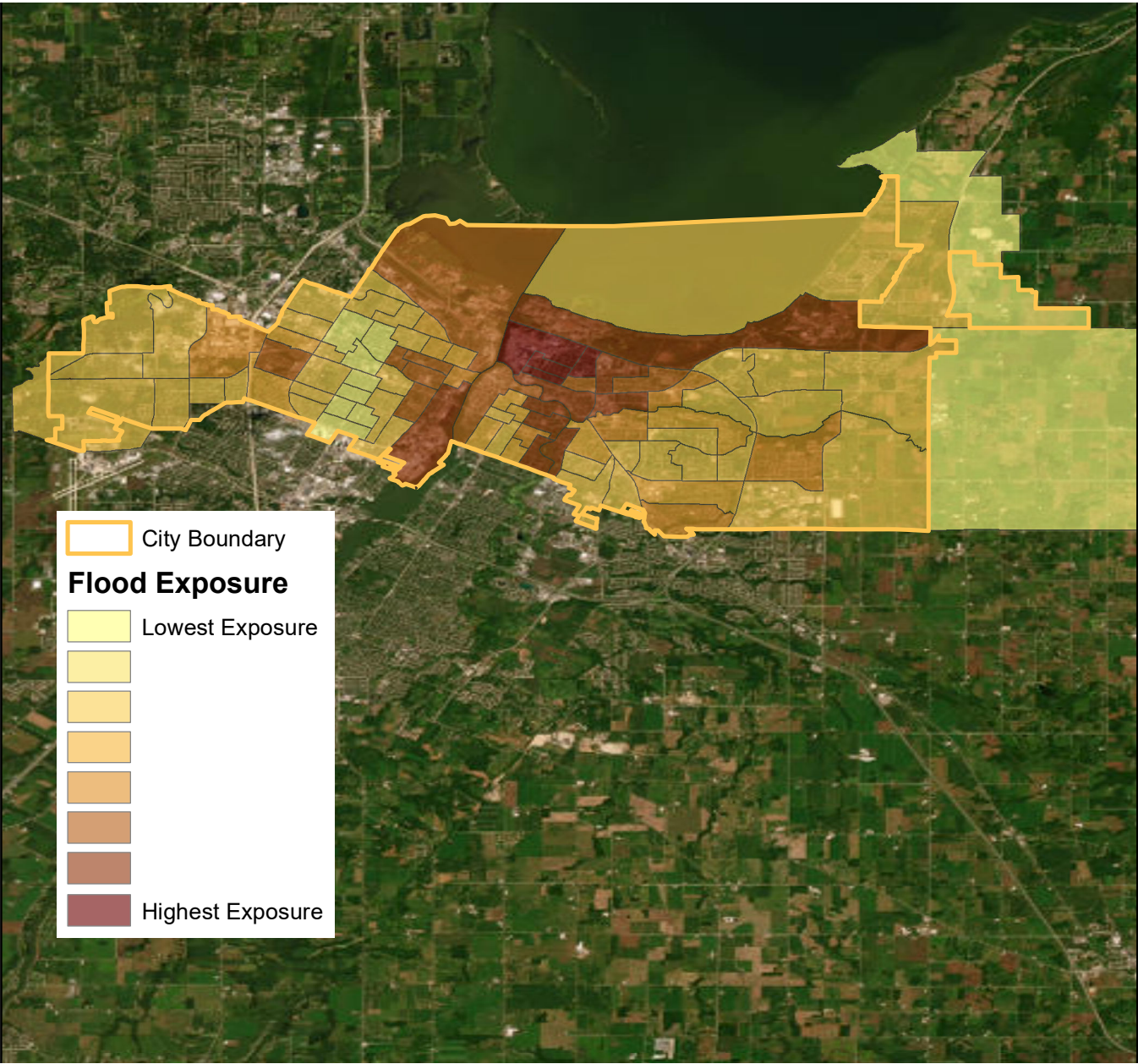
Indicator	Description	Geography	Source
Percent Impervious Surface	Percent of the census block group area classified as High Density Development or Low Density Development	Census Block Group	WISCLAND 2.0
Percent High Density	Percent of the census block group area classified as High Density Development	Census Block Group	WISCLAND 2.0
Percent Flood Parcels	Percent of the parcels in the census block group that intersect with the 500-year floodplain	Census Block Group	FEMA Flood Maps; Wisconsin Department of Administration Parcel Data
Percent Flood Roads	Percent of road miles in the census block group within the 500-year floodplain	Census Block Group	FEMA Flood Maps; TIGER/Line Road Dataset
Percent Floodplain	Percentage of the land area in the census block group within the 100-year floodplain	Census Block Group	Wisconsin Risk Assessment Flood Tool (RAFT)
Proximity SFHA	Average proximity of a resident to the floodplain in the census block group	Census Block Group	Wisconsin Risk Assessment Flood Tool (RAFT)
Percent Poorly Drained Soils	Percentage of the census block group that has "poorly" or "very poorly" drained soils	Census Block Group	Natural Resources Conservation Service Gridded Soil Survey Geographic Database

After collecting the raw data, indicators were then normalized so all values were between 0 and 1, with the highest initial value for each indicator transforming to a value of 1 and the lowest initial value transforming to 0. The Proximity to SFHA indicator was transformed by $(1 - x)$, where x represents the normalized indicator value for that census block group. This resulted in higher values representing higher levels of exposure across all indicators. Using the resulting dataset, a Principal Component Analysis (PCA) was performed using Stata. PCA is a technique to reduce the dimensionality of a large dataset without losing much of the information within the dataset. It is commonly used to create indices and has been frequently used to creating social and flood vulnerability indices. All principal components (PCs) with an eigenvalue less than 1 were removed, resulting in two PCs remaining. Those two PCs contained 75% of the variation in the original data. Predicted values for each of the PCs were then estimated for all census block groups. The predicted values were then weighted by the proportion of the variation explained by the given PC. For example, PC1 explained 62% of the variation captured by the PCA. Therefore, predicted estimates for PC1 were weighted as 62% of the final index score. Weighted scores were then summed to get the index score. Finally, index scores were normalized so all values were between 0 and 1 to get the final index score. Higher scores represent higher levels of flood exposure. All index scores are relative to the 208 census block groups in the project area. Index scores were then mapped by census block group (Figure 8).

Results

Flood exposure in the City of Green Bay is highest along the East River and Fox River, in addition to the coastal area. This is largely due to a significant proportion of the land area within the floodplain, including the substantial overlap with roadways and parcels. These districts, particularly the downtown region near the outlet of the East River, also has high levels of impervious surface and high density of development, which suggests a susceptibility to pluvial flooding, or flooding that can occur independent of an overflowing river. During extreme rain events, pluvial flooding can become more severe as stormwater conveyance is limited by outlets that are also affected by high water. Areas along the East River and coastal zone also have a higher prevalence of poorly drained soils. The census block group on the west side of the Fox River along Highway 54/Mason also has a high level of flood exposure, primarily due to the proportion of land area covered by the floodplain.

Figure 8. Map of Flood Exposure Index



Social Vulnerability Analysis

- The east side of Green Bay, particularly along the East River, and the west side of the city along the Fox River and coastal area have the highest levels of social vulnerability.

Flooding does not affect everyone in the same way. There are social, economic, and demographic characteristics that can make an individual or neighborhood particularly vulnerable to flood events during both the response and recovery phase of the disaster. These social, economic and demographic characteristics all affect flood vulnerability in a different way. Indexing is a means to capture that multi-dimensionality.

Higher wealth individuals and households are less vulnerable to flood disasters, as they are more likely to have resources to protect themselves from flood damage as well as fund recovery after a flood event. Conversely, things such as race, age, housing condition, education, employment, and more can increase flood vulnerability. For example, racial and ethnic minorities are more likely to be disproportionately affected by flooding. Any limitations in English proficiency can limit an individual’s ability to understand and act on emergency communications. Youth and elderly populations can have limited autonomy and mobility to respond quickly to flood events. Mobile homes may lack the structural integrity to withstand flood waters. Those who are renting their homes may have less recourse to recover after a flood and are less likely to receive the benefits of flood insurance compared to owner occupied homes.

The Center for Disease Control (CDC) created a Social Vulnerability Index to provide, “socially and spatially relevant information to help public health officials and local planners better prepare communities to respond to emergency events such as severe weather, floods, disease outbreaks, or chemical exposure” (CDC/ATSDR SVI 2020 Documentation). The University of South Carolina’s Hazards and Vulnerability Research Institute similarly created a Social Vulnerability Index focused on natural disasters. Areas with higher levels of social vulnerability may require more resources during the response and/or recovery phase of a flood. These readily available indices are calculated at the county or census tract scale, which can sometimes be too coarse to provide useful spatial information within a city. For example, the city of Algoma is represented by a single census tract. For this project, an updated Social Vulnerability Index was calculated at the smallest unit of published census data, the census block group. A census block group typically represents an area inhabited by 600 to 3000 people (compared to a census tract, which represents 1200 to 8000 people). Compared to the CDC’s index, the Social Vulnerability Index created for this project represents a sharper spatial resolution to better identify differences in social vulnerability across a city. Additionally, the index created for this project uses data from the 208 census block groups that cover the 9 cities in the project area, not the entire country, which better controls for differences across space.

Social Vulnerability Index Methodology

A Social Vulnerability Index was created at the census block group level for all census block groups that intersect with the municipal boundaries of the nine project area cities. The indicators selected for this analysis largely mirror indicators in other similar analyses, including the CDC’s and University of South Carolina’s Social Vulnerability indices. The Principal Component Analysis method was adopted from the University of South Carolina’s methods, as well as the method outlined in Tate et al. (2021).

Data was first downloaded from the U.S. Census website. Census block groups from 2021 were used. In almost all cases, data was taken from the 2020 5-year estimates of the American Community Survey (ACS). For some indicators, data from the Decennial Census was used. Due to the elimination of some census block groups in the City of Green Bay after redistricting, 2019 data was used to preserve the spatial variability. This assumes that the sociodemographic characteristics within the 2019 census block groups did not change significantly to 2020.

One indicator – Averaged Assessed Value – was calculated using parcel data from the Wisconsin Department of Administration. That indicator represents the averaged assessed value of residential parcels within each census block group.

A table of the indicators used in the Social Vulnerability Index and their description is provided in Table 5.

Table 5. Indicators Used in the Social Vulnerability Index

Variable Name	Description	Universe	Geography	Source
Pct Youth and Elderly	Percentage of population Under 14 or older than 65	Total Population	Census Block Group	US Census/American Community Survey
Median Age	Median age	Total Population	Census Block Group	US Census/American Community Survey
Pct No College	Percentage of population without an Associate's Degree	Population 25 years and older	Census Block Group	US Census/American Community Survey
Pct Not Working	Percentage of population unemployed or not working	Population 16 years or older	Census Block Group	US Census/American Community Survey
Pct Hispanic	Percentage Hispanic or Latino	Total population	Census Block Group	US Census/American Community Survey
Pct Single Parent	Percentage of families with children that are not married	Population with own children under 18 years	Census Block Group	US Census/American Community Survey
Percent Crowded	Percentage of housing units with more than one occupant per room	Occupied housing units	Census Block Group	US Census/American Community Survey
Pc t Female	Percentage of population that is female	Total population	Census Block Group	US Census/American Community Survey
Pct Renter	Percentage of housing units that are occupied by renters	Occupied housing units	Census Block Group	US Census/American Community Survey
Pct Mobile Home	Percentage of housing units that are mobile homes	Housing units	Census Block Group	US Census/American Community Survey
Vacancy Rate	Percentage of housing units that are vacant	Housing units	Census Block Group	US Census/American Community Survey
Per Capita Income	Per capita income in the past 12 months (2019 inflation adjusted dollars)	Total population	Census Block Group	US Census/American Community Survey
PctIncome 100k	Percentage of households with income greater than \$100,000 in the past 12 months	Households	Census Block Group	US Census/American Community Survey
Pct Non White	Percentage of the population that is Black, American Indian, Asian, Native Hawaiian or Pacific Island, Other race, or two or more races	Total population	Census Block Group	US Census/American Community Survey
Pct Not English Home	Percentage of population that does not speak English at home	Population 5 years and older	Census Block Group	US Census/American Community Survey
Pct Rent Stress	Percentage of housing units where renter pays more than 30% of income to rent	Renter occupied housing units	Census Tract	US Census/American Community Survey
Pct No Health Insurance	Percentage of the populations without health insurance	Civilian non-institutionalized population	Census Tract	US Census/American Community Survey
Pct No Vehicle Available	Percentage of households with no vehicle available	Households	Census Tract	US Census/American Community Survey
Avg Assessed Residential Value	Averaged assessed value of residential parcels	Residential parcels	Census Block Group	State Parcel Data - DOA

Data for 208 census block groups across the nine project area cities was downloaded. All indicators represent a percentage of the subject population, except Median Age, Per Capita Income, and Averaged Assessed Value, which maintain their raw value. Indicators were then normalized so all values were between 0 and 1, with the highest initial value for each indicator transforming to a value of 1 and the lowest initial value transforming to 0. Values of some indicators were then transformed so that for all indicators, higher values corresponded to higher levels of vulnerability. That transformation consisted of $(1 - x)$, where x represents the normalized indicator value for that census block group, for the following indicators: Associate's Degree, Married, Uncrowded, Owner Occupied, Per Capita Income, Income \$100K, White, English at Home, Averaged Assessed Value.

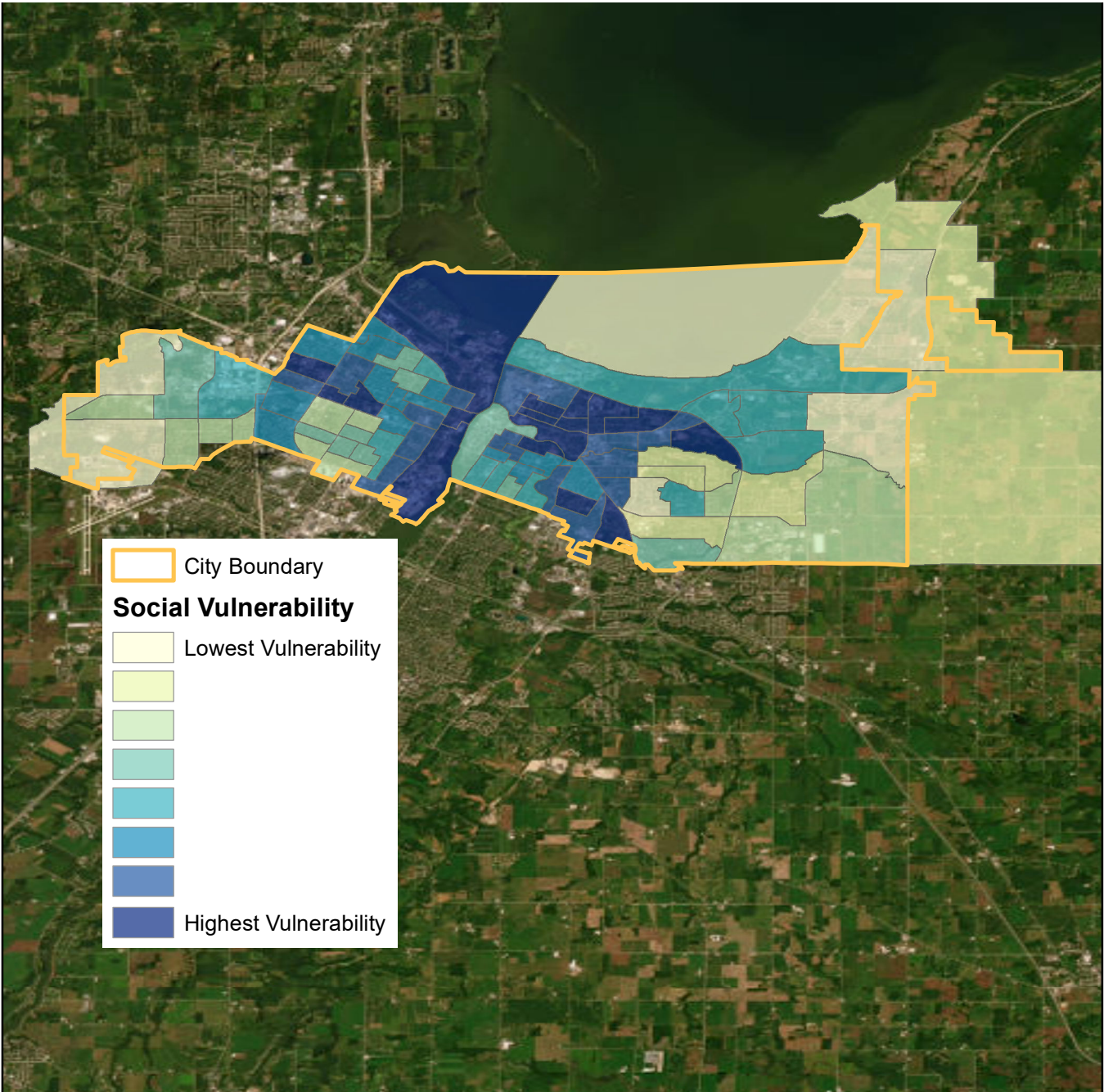
Using the resulting dataset, a Principal Component Analysis (PCA) was performed using Stata. PCA is a technique to reduce the dimensionality of a large dataset without losing much of the information within the dataset. It is commonly used to create social and flood vulnerability indices. All principal components (PCs) with an eigenvalue less than 1 were removed, resulting in seven PCs remaining. Those seven PCs contained 72.2% of the variation in the original data. Predicted values for each of the seven remaining PCs were then estimated for all census block groups. The predicted values were then weighted by the proportion of the variation explained by the given PC. For example, PC1 explained 26.0% of the cumulative 72.2% of total variation explained. Therefore, predicted estimates for PC1 were weighted as 36% ($26.0/72.2$) of the final index score. Weighted scores were then summed to get the index score. Finally, index scores were normalized so all values were between 0 and 1 to get the final index score. Higher scores represent higher levels of social vulnerability. All index scores are relative to the 208 census block groups in the project area. Index scores were then mapped by census block group (Figure 9), where darker shades of blue indicate higher levels of social vulnerability.

Results

Large portions of the City of Green Bay's east side and areas adjacent to the Fox River have high levels of social vulnerability. The census block groups along the East River are characterized by relatively low per capita income and few high-income earners, which puts pressure on rent stress. The census block groups also have a slightly higher rate of single-parent households, and are less likely to have health insurance. This area also has a relatively higher proportion of Hispanic and non-white residents. Taken together, the relatively low levels of resources available to this part of the city, exacerbated by historic disparities across racial groups, may limit the resident's ability to prepare for, and recover from, flood events. Residents in the census block groups adjacent to the western bank of the Fox River also have relatively lower levels of income, as well as higher rates of single-parent households and renter households. Renters, particularly those with limited income, may have limited ability or authority to improve the flood resilience of the properties they are renting or access resources during recovery from a flood event. Across the city, Green Bay has some indicators that suggest relatively greater social resilience, including a slightly younger median age when compared to the other census block groups in the eight other cities used in this analysis. Younger populations are less likely to have mobility limitations during flood events. The city also has relatively low vacancy rates, making it less likely there will be neglected homes that can cause public health threats in the event of a flood.

There are some limitations to this analysis. Most notably, using data at the census block group level introduces greater margins of error because the American Community Survey only samples a subset of the population each year. However, it is important to look at sociodemographic data at the most granular level possible to better understand differences across space. For example, the City of Algoma is almost entirely covered by a single census tract, which makes it impossible to understand differences in the population in different parts of the city. To correct for these relatively higher margins of error, 5-year estimates, which incorporate survey data from the previous five years, were used. Many indicators were also summed to form a single value, which reduces the margin of error. For example, to get a value for Percentage Youth and Elderly, all estimates for the population aged under 5, 5-9, 10-14, 65-66, 67-69, 70-74, 75-79, 80-84, and older than 85 were summed. To verify this method did have the desired effect on margin of error, the coefficient of variation was determined consistent with guidance from the U.S. Census Bureau. Most indicators had a coefficient of variation around 30%. Three indicators – Percentage Rent Stressed, Percentage Without Health Insurance, and Percentage with No Vehicle – still had large margins of error or high coefficients of variation. Therefore, the census tract values for these three variables were assigned to all census block groups in the respective census tract. Another limitation is that it is likely impossible to fully capture all aspects of social vulnerability. Therefore, there may be some omitted variables in this analysis. However, the variables selected for this analysis are common across other social vulnerability studies.

Figure 9. Map of Social Vulnerability Index



Combined Social Vulnerability and Flood Exposure

- Areas along the East River, particularly the census block groups near the outlet of the East River with the Fox River, have a high concentration of combined social vulnerability and flood exposure.

Areas in which there are high levels of both flood exposure and social vulnerability are areas in which residents are more likely to be affected during all phases of the disaster cycle. They will be simultaneously most affected by the physical impacts of flooding and have the most limited capacity to respond to and recover from a flood event. These areas may require targeted response procedures or additional resources in recovery. Consistent with other studies on the relationship between social vulnerability and flood exposure (Tate et al. 2021; Koks et al. 2015; Lieberman-Cribbin et al. 2021), census block groups with high levels of flood exposure are correlated with high levels of social vulnerability (Figure 10). The red line in the chart is a linear trendline indicating that as a census block group's flood exposure increases, so does its social vulnerability index score.

Figure 10. Correlation of flood exposure and social vulnerability

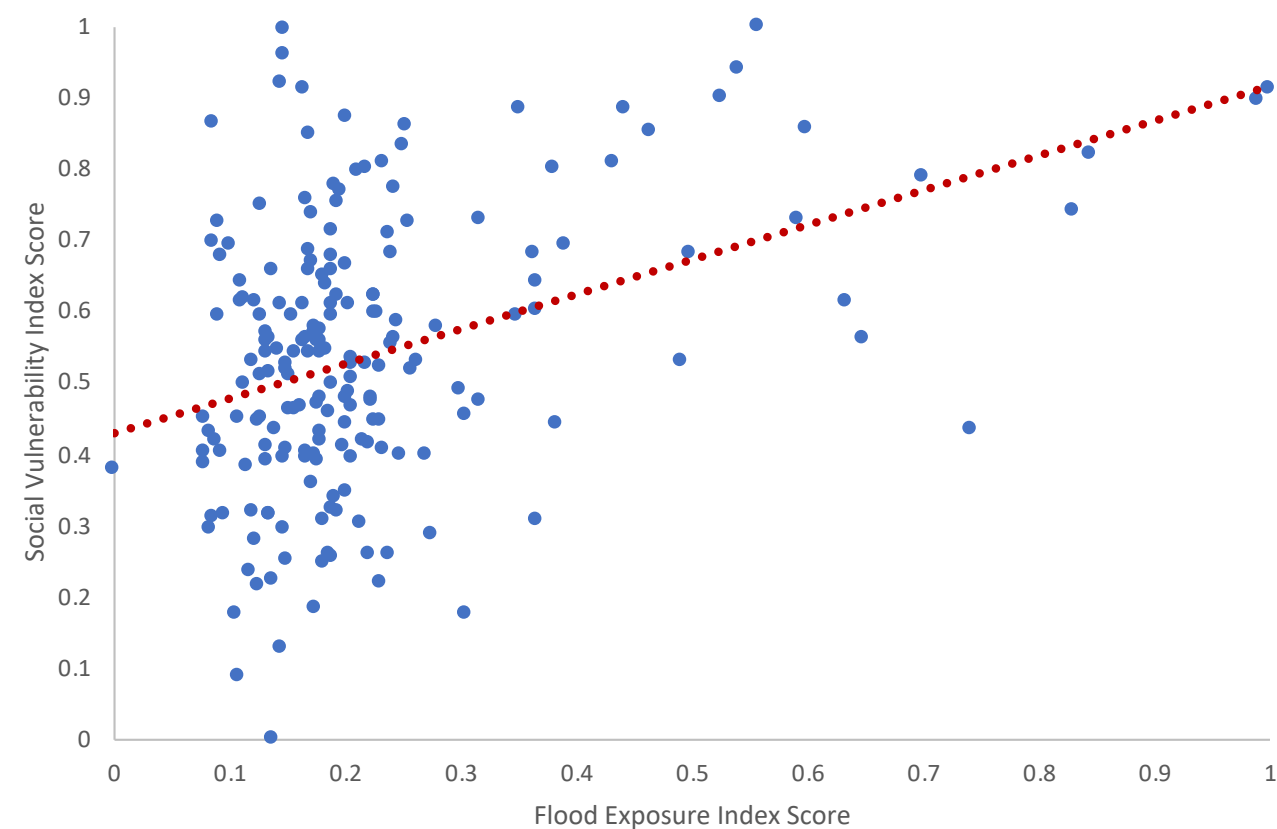
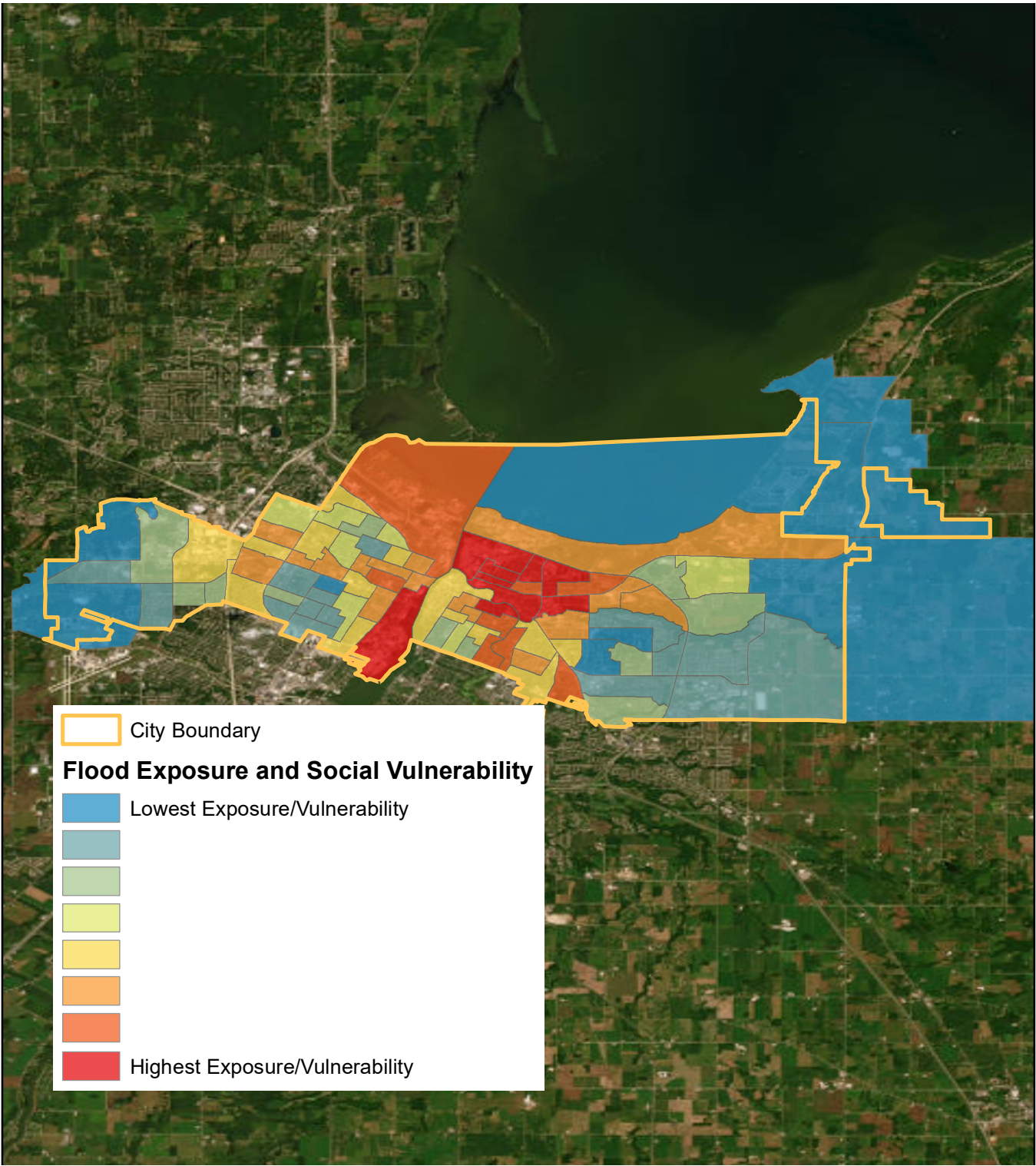


Figure 11 shows the combined flood exposure and social vulnerability by census block group for the community by summing the two index scores. Areas colored red indicate census block groups with the highest combined flood exposure and social vulnerability, while blue areas indicate areas of low combined exposure and vulnerability.

Consistent with the earlier analysis, the east side of Green Bay, particularly the areas adjacent to the East River, and the west bank of the Fox River have the highest combined flood exposure and social vulnerability. This suggests that residents of this census block group are disproportionately affected by flood events, but also have a more limited capacity to respond to, and recover from, flood events. This district may one to prioritize for special consideration during preparedness, response, and mitigation.

Figure 11. Map of combined flood exposure and social vulnerability



Conclusion

Northeast Wisconsin is projected to experience an increasing frequency and severity of extreme rainfall events. Throughout the region, the probability of these extreme events is already being underestimated in standard estimates of precipitation and flood risk, which is likely to continue as temperatures rise across the state. That increase in extreme rainfall, particularly the 1% AEP rainfall, interacts with increasingly volatile lake levels in cities with combined riverine and Lake Michigan coastal features to amplify flood exposure.

Throughout the study area, the flood exposure of a census block group was shown to be correlated with social vulnerability, meaning populations that are already overburdened during the preparation, response, and recovery phases of a flood event are also more exposed to flood events. Using the information provided in this report, communities can evaluate the adequacy of their disaster preparedness, response, and recovery procedures in addressing these vulnerable populations. The analysis also identifies areas of greatest flood exposure and social vulnerability which may need special attention in flood mitigation activities.

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Heat Vulnerability Index For Brown County, Wisconsin

 Municipal Boundary

 Oneida Reservation

Heat Vulnerability Index

 5 (Highest)

 4

 3

 2

 1 (Lowest)

This map uses a Heat Vulnerability Index (HVI) to illustrate the relative risk of heat-related illnesses among the population for census tracts in Brown County, Wisconsin. The HVI is a composite measure that combines three key indicators: Exposure, Sensitivity, and Adaptive Capacity. Exposure includes environmental risk factors such as impervious surfaces and tree cover. Factors that affect Sensitivity of people to extreme heat include housing, chronic health conditions, and age. Adaptive Capacity refers to a community's ability to cope with and recover from extreme heat and is measured based on access to air conditioning, healthcare facilities, awareness, and emergency plans. Census tracts with an HVI score of 5 represent those who are at greatest risk to extreme heat-related illness.

Source: U.S. Census, Brown County, Centers for Disease Control; CDC, NLCD 2019 Percent Developed Imperviousness (CONUS), 2016 USFS Tree Canopy Cover (CONUS), HVI methodology is based on (shape, 2022)

Spatial Reference

Name: WGS 1984 Web Mercator Auxiliary

Sphere

Datum: WGS 1984



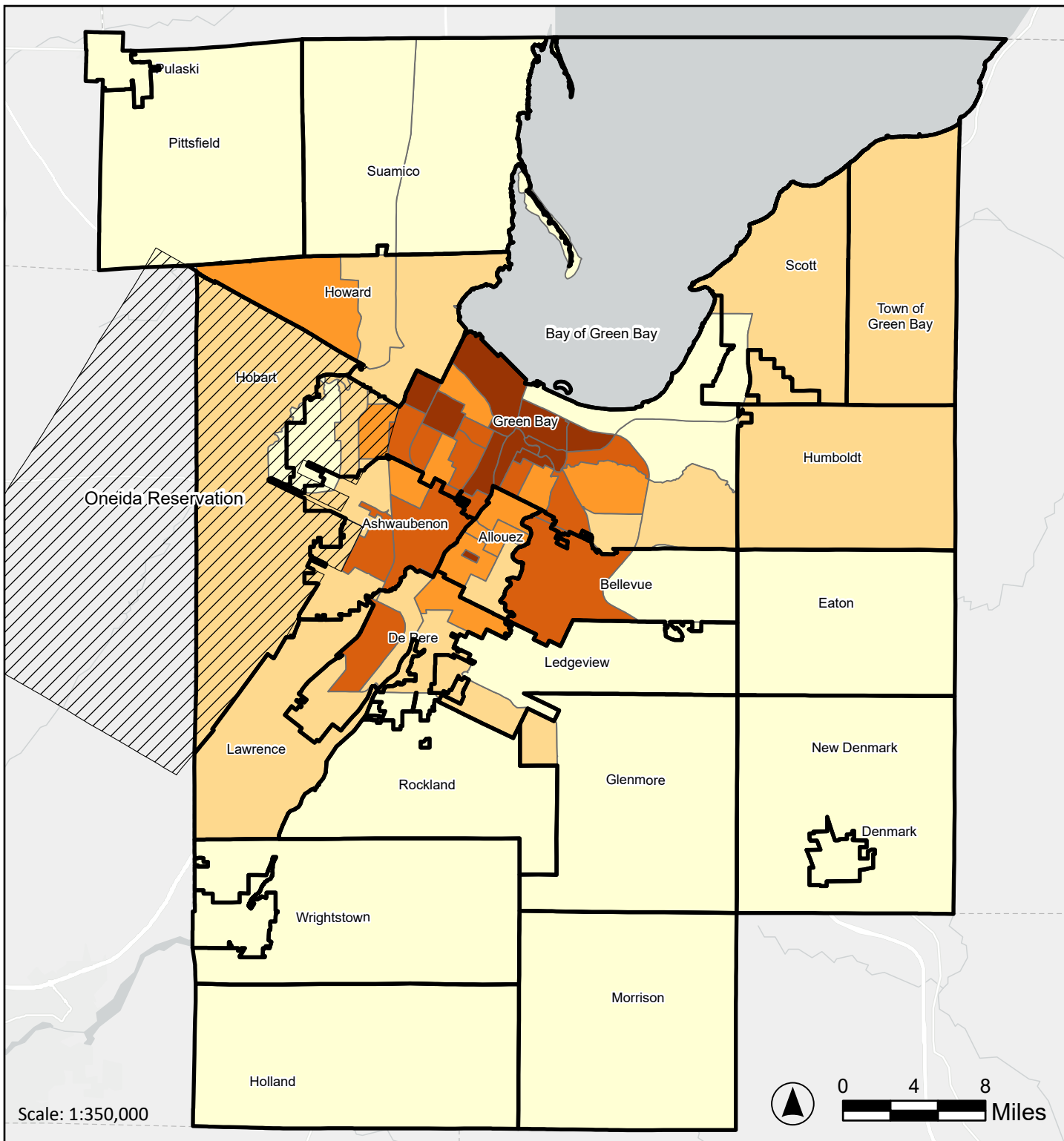
Designed by: Abdullahi Bihi

Date: 3/14/2024

Scale: 1:350,000



0 4 8
Miles





Report to the
Sustainability Commission
of the City of Green Bay

MEETING DATE

April 17, 2024

AGENDA ITEM # F.I

Discussion and possible action to make a presentation to the Common Council of the 2024-2025 Sustainability Commission work plan in June 2024.

BACKGROUND

RECOMMENDATION

FISCAL IMPACT

ATTACHMENTS

None



Report to the
Sustainability Commission
of the City of Green Bay

MEETING DATE

April 17, 2024

AGENDA ITEM # G.I

Review the amended 2024-25 Sustainability Commission Work Plan from March 20, 2024 meeting.

BACKGROUND

RECOMMENDATION

FISCAL IMPACT

ATTACHMENTS

- I. 2024_03_22 GB Sustainability Commission Plan 2024-25_amended

City of Green Bay Sustainability Commission 2024-25 Work Plan

Purpose of this Document: This work plan is intended to focus on the work of the Sustainability Commission and to provide transparency to the Common Council, Mayor, city staff, and citizens of Green Bay. While there are many sustainability issues that need addressing, we have limited our focus to these four categories and identified specific goals and actions that we as a city can tangibly address. This document is not a final product, but rather an overview of what we intend to take on. This document also outlines how we may consider new issues that are brought to our attention throughout the year, and general principles on how we will act on all of our goals. We will update our work plan at the beginning of every year. The duration of this document will coincide with the appointed alderperson's two-year terms.

Process: Once developed, all actions and proposals outlined in this work plan will go from the Sustainability Commission to the necessary committee or staff before going to Common Council. We know that every action we propose must be rooted in data and make effective use of limited financial and staff resources, while addressing environmental impacts, and improving the quality of life in Green Bay. Sustainability, after all, considers the long-term economic, social, and environmental costs of the impact of our actions as a community. Those unsure of the proven data that back our proposals are welcome to ask questions when presented to them. This work plan is not a data-driven policy proposal but an internal tool to drive and provide transparency to our work.

Clean Energy:

- **Goals**
 - 100% clean energy and carbon neutrality for the City of Green Bay by the year 2050 (Resolution 5/4/2021).
 - ~~100% clean energy for city operations by 2050~~
 - ~~100% clean energy for the community by 2050~~
- **Research, Data, or Evidence**
 - Clean Energy Green Bay plan - adopted December 2023
- **Actions**
 - Develop tracking and reporting methods to assess progress on CEGB implementation.
 - Organize a business and industry working group to share best practices that result in reducing energy consumption and greenhouse gas emissions.
 - Support Energy Engagement & Outreach Specialist employee in education and outreach for community.
 - Provide support for city operational projects and upgrades.
- **Target Dates**
 - ~~Develop~~ Research possible carbon emissions tracking and reporting tools the City could use by the end of 2024.
 - Launch business working group by 2025.
 - Other actions are ongoing.
- **Partners**
 - Internal City employee energy team (not formed yet)
 - WPS
 - Wisconsin Local Government Climate Coalition
 - Green Bay Metro Transit
 - Green Bay Water Utility
 - Green Bay Neighborhoods
 - Focus on Energy
- **Funding Sources**
 - Grants
- **Point People:** Seth Hoffmeister, Christa Kananen, Jenny Brinker

City of Green Bay Sustainability Commission 2024-25 Work Plan

Climate Resilience:

- **Goal:** Strengthen the community's resilience and adaptive capacity to climate-related hazards.
- **Research, Data, or Evidence**
 - Summary document of local climate changes, projections and impacts (UW Sea Grant) (pending April 2024)
 - Flood vulnerability analysis (UW Sea Grant)
 - Heat Vulnerability analysis (UW Sea Grant) (pending March 2024)
 - "Perfect storm" coastal flooding scenario (UW Sea Grant) (pending May 2024)
 - Flood Resilience Community Assessment Summary (East River Collaborative, 2022)
 - City of Green Bay Green Stormwater Infrastructure Plan (2023)
 - City of Green Bay Comprehensive Plan (in development)
- **Actions**
 - Identify social, economic and environmental risks due to projected impacts.
 - Integrate Commission's sustainability goals into comprehensive plan.
 - Identify opportunities to increase resilience through greening the city (e.g., native plantings, GSI, trees)
- **Target Dates**
 - Ongoing
- **Partners**
 - UW Sea Grant
 - East River Collaborative
 - NEW Water
 - The Nature Conservancy
- **Funding Sources**
 - Wisconsin Coastal Management Program
 - Fund for Lake Michigan
 - NOAA
 - National Fish and Wildlife Foundation
- **Point Person:** Julia Noordyk

Healthy Habitat for All:

- **Goal:** To create and preserve connected, productive, and safe habitat corridors in Green Bay's land, air and water by 2030.
- **Research, Data, or Evidence**
 - Maps of pollinator habitat
 - Other municipality experience with Integrated Pest Management
- **Actions**
 - Assist and recognize pollinator habitat plantings by GBCC and other groups.
 - Explore using native plants first as city policy.
 - Establish pesticide use policy for City operations.
- **Target Dates**
 - Use GBCC maps from 2023 to identify areas to plant in 2024-25. Plant/advertise plantings beginning May 2024. Advertise PC Survey beginning Jan 2024.
 - Explore native plant policy beginning in April 2024 for May 2025 implementation.
 - Pass pesticide use policy by April 2024.
- **Partners**

City of Green Bay Sustainability Commission 2024-25 Work Plan

- Wild Ones
- NEW Master Gardeners
- Green Bay Conservation Corps.
- DNR
- U.S. Fish and Wildlife Service
- Green Bay Conservation Partners
- Neighborhood Associations
- **Funding Sources**
 - Green Bay Conservation Corps
 - Grants
 - Neighborhood donations
- **Point People:** Ned Dorff, Kaurie Mihm

Waste Reduction:

- **Goal:** Reduce amount of organic waste entering our landfill system
- **Research, Data, or Evidence**
 - USDA Composting & Food Reduction Program
 - US EPA Food waste program
 - ReFED
 - Wisconsin municipal programs
- **Actions**
 - Establish a program to provide home composting bins throughout the community.
 - Establish pilot collection program.
 - Identify end location and use for organic material.
 - Educate the public on food waste reduction.
 - Reduce contamination.
- **Target Dates**
 - Compost bin sales in 2025.
- **Partners**
 - Public Works
 - Parks Dept.
 - UWGB
 - NWTC
 - Organics Facility/Farm
 - Compost Collector
- **Funding Sources**
 - USDA Composting & Food Reduction Cooperative Agreements
 - US EPA Grant Programs
- **Point People:** Mark Walter

Marketing and Public Outreach:

- **Goal:** Increase visibility of and build support for the City's sustainability goals and achievements.
- **Research, Data, or Evidence**
- **Actions**
 - Identify important City initiatives and promotional opportunities.
 - Participate in and table at three community events annually.
 - Help create content for ~~Create~~ a website hub of sustainability information.

City of Green Bay Sustainability Commission 2024-25 Work Plan

- Participate in at least one service project with an area sustainability partner.
 - Explore options for sustainability related notifications through email.
- **Target Dates: Ongoing**
- **Partners**
 - Green Bay Conservation Corps
 - Bid Districts
 - Neighborhood Associations
- **Funding Sources**
 - Advise staff to incorporate digital marketing ~~Add communication~~ budget within grant proposals.
 - Under investigation: Add City budget item for promoting City of Green Bay sustainability.
- **Point People:** Kaurie Mihm, Julia Noordyk, ~~Mark Steuer~~

Criteria for Taking on New Issues:

The Sustainability Commission will use these goals to guide our work, however we rely on input from community members to drive our work. Any ideas from council members, other city staff, or citizens will be considered with the following questions in mind:

- How does this fit in with the current goals?
- Can taking this on help further the mission and make an impact on sustainability in Green Bay?
- Who will be leading this effort? Commission members? Citizen? City staff? What is the capacity to take this on?
- What research is required to move forward on this?
- If the Sustainability Commission is unable to take on new issues, can it be revisited in the future?
- Is the Sustainability Commission the most appropriate board to address this? Is there a committee, commission, or department better suited to address it?

General Goals and Principles for Each Issue Area:

- Community Involvement: Our work will be more effective when the public is informed and involved in developing and implementing work identified in the work plan. We will strive to create pathways for involvement in all facets of our work, including but not limited to creating work groups, hold listening sessions, speaking to organizations, distributing surveys, and seeking the input of our fellow neighbors.
- Public Outreach and Awareness: We will strive to amplify our work to the community. Specifically, we will increase our social media and web presence, and update the Sustainability Commission webpage to include relevant information to ongoing work.
- Racial Justice, and Equity: Often those most impacted by pollution are the most marginalized in our society. We see the intersections between race, class, and environmental impacts and will center that in our work. We will strive to involve community members most impacted by environmental injustice to be a part of the solutions.
- Data and Research Driven: There are volumes of peer-reviewed data and research on the issue areas. The Sustainability Commission knows it is important to present reasons why our solutions will help and will include detailed reasons why before any votes by the Common Council. This commission has members with expertise in a variety of issue areas, and access to networks of experts outside of our skill sets.

City of Green Bay Sustainability Commission 2024-25 Work Plan

- Fiscal Responsibility: Sustainability projects done right can save the city and community money in the long-term. Every policy proposal and action brought forth will demonstrate that. Even with long-term cost savings, we recognize up-front costs of implementing sustainability proposals can be a constraint. As such, the Sustainability Commission will identify grant funding opportunities, volunteer experts, and present Common Council with the most fiscally responsible options with any possible policies.



Report to the
Sustainability Commission
of the City of Green Bay

MEETING DATE

April 17, 2024

AGENDA ITEM # G.2

Resiliency Coordinator Report

BACKGROUND

RECOMMENDATION

FISCAL IMPACT

ATTACHMENTS

None



Report to the
Sustainability Commission
of the City of Green Bay

MEETING DATE

April 17, 2024

AGENDA ITEM # G.3

The meeting for May 15 will be canceled.

BACKGROUND

RECOMMENDATION

FISCAL IMPACT

ATTACHMENTS

None



Report to the
Sustainability Commission
of the City of Green Bay

MEETING DATE

April 17, 2024

AGENDA ITEM # G.4

Next Sustainability Commission meeting: **June 19** at 5:00pm.

BACKGROUND

RECOMMENDATION

FISCAL IMPACT

ATTACHMENTS

None