



Metropolitan Water Reclamation District of Greater Chicago

**Welcome to the December
Edition of the 2023 M&R
Seminar Series**

NOTES FOR SEMINAR ATTENDEES

- Remote attendees' audio lines have been muted to minimize background noise. **For attendees in the auditorium, please silence your phones.**
- A question and answer session will follow the presentation.
- For remote attendees, please use the "**Chat**" feature to ask a question via text to "**Host.**" **For attendees in the auditorium, please raise your hand and wait for the microphone to ask a verbal question.**
- The presentation slides will be posted on the MWRD website after the seminar.
- This seminar has been approved by the ISPE for one PDH and has been approved by the IEPA for one TCH. Certificates will only be issued to participants who attend the entire presentation.

Kuldip Kumar, Ph.D.
Principal Environmental Scientist
Metropolitan Water Reclamation District of Greater Chicago
Monitoring and Research Department



Dr. Kumar joined the District in 2006, and currently serves as Principal Environmental Scientist and leads the New Technology Evaluation Program at the District. This program evaluates technologies to optimize wastewater treatment in areas like reliability, maintenance, energy use, and safety. Dr. Kumar is also involved in developing the MWRD's Climate Action Plan and Sustainability and Resiliency Action Plans. With over 90 publications, Dr. Kumar holds a patent for a wastewater treatment method. In 2020, he received the Ralph Fuhrman Medal for Outstanding Water Quality Academic-Practice and the Innovation Collaboration of the Year Award from the Algae Biomass Organization.

The MWRDGC's Update on the Climate Action Plan and Greenhouse Gas Emissions

Kuldip Kumar, Ph.D
Principal Environmental Scientist

December 15
2023 M&R Seminar Series



Metropolitan Water
Reclamation District
of Greater Chicago

Climate Action Plan

Metropolitan Water Reclamation
District of Greater Chicago

May 4, 2023





Task Force Team

M&R

Jonathan Grabowy
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Human Resources

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Brittney Wyatt

Treasury

Wendy Sin

Public Affairs

Justin Brown

Law

Anastasios Foukas

IT

John Sudduth



United Nations
Climate Change

The different

futures that

lie ahead.

**MWRDGC
Climate
Goals**

+1.5 °C

+2 °C

+3 °C

Climate Goals



MWRD Targets (from 2005 Level)

Baseline Targets

2025 - 28% Reduction

2050 - 80% Reduction

Stretch Targets

2025 - 50% Reduction

2050 - Achieve Net Zero Emissions

Interim Target

2040 – 60% reduction

General Principles for Developing a Climate Action Plan

GHG Emissions Accounting

- Greenhouse gases
- Boundary: MWRD facilities - 7 WRRFs, 23 pumping stations, solids processing, office buildings, and land under trees etc.
- Emissions attribution – different sources within the above boundary
- Emission classification – Scope 1, Scope 2, Scope 3, & Sinks
- Calculation
- Data precision

GHG Mitigation Planning & Actions

Adaptation Strategies

In early 2029, Earth will likely lock into breaching key warming threshold, scientists calculate

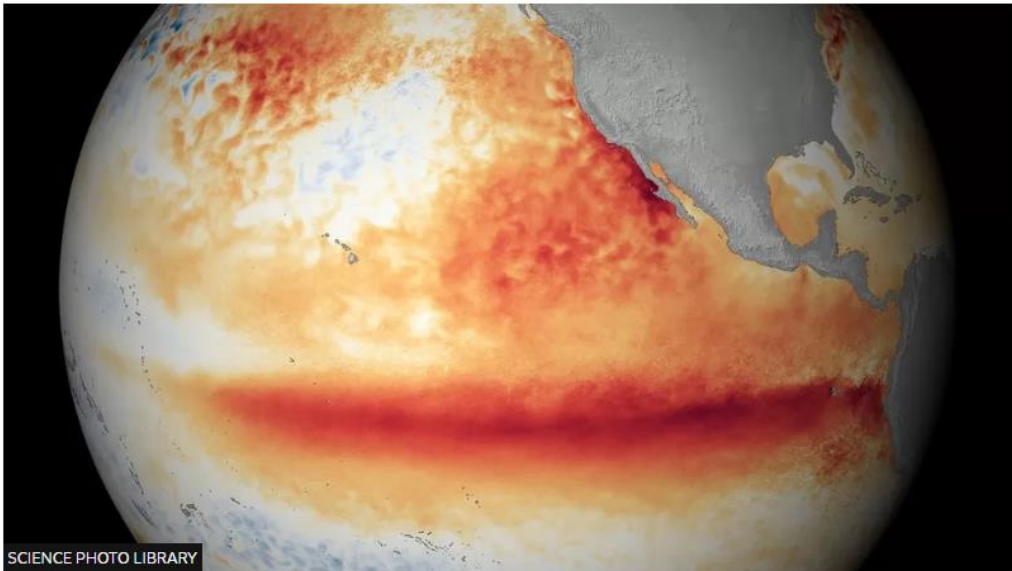
A new study says that in a little more than five years the world will likely be unable to stay below the internationally agreed temperature limit for global warming if it continues to burn fossil fuels at its current rate

By SETH BORENSTEIN AP science writer
October 30, 2023, 11:00 AM



Global warming set to break key 1.5C limit for first time

17 May · Comments



SCIENCE PHOTO LIBRARY



Extreme rainfall increases exponentially with global warming: study

AFP
Mon, November 27, 2023 at 9:58 AM CST · 2 min read



This aerial view shows a general view of a flooded area in Dolow, Somalia following devastating floods on November 25 (Hassan Ali Elmi)

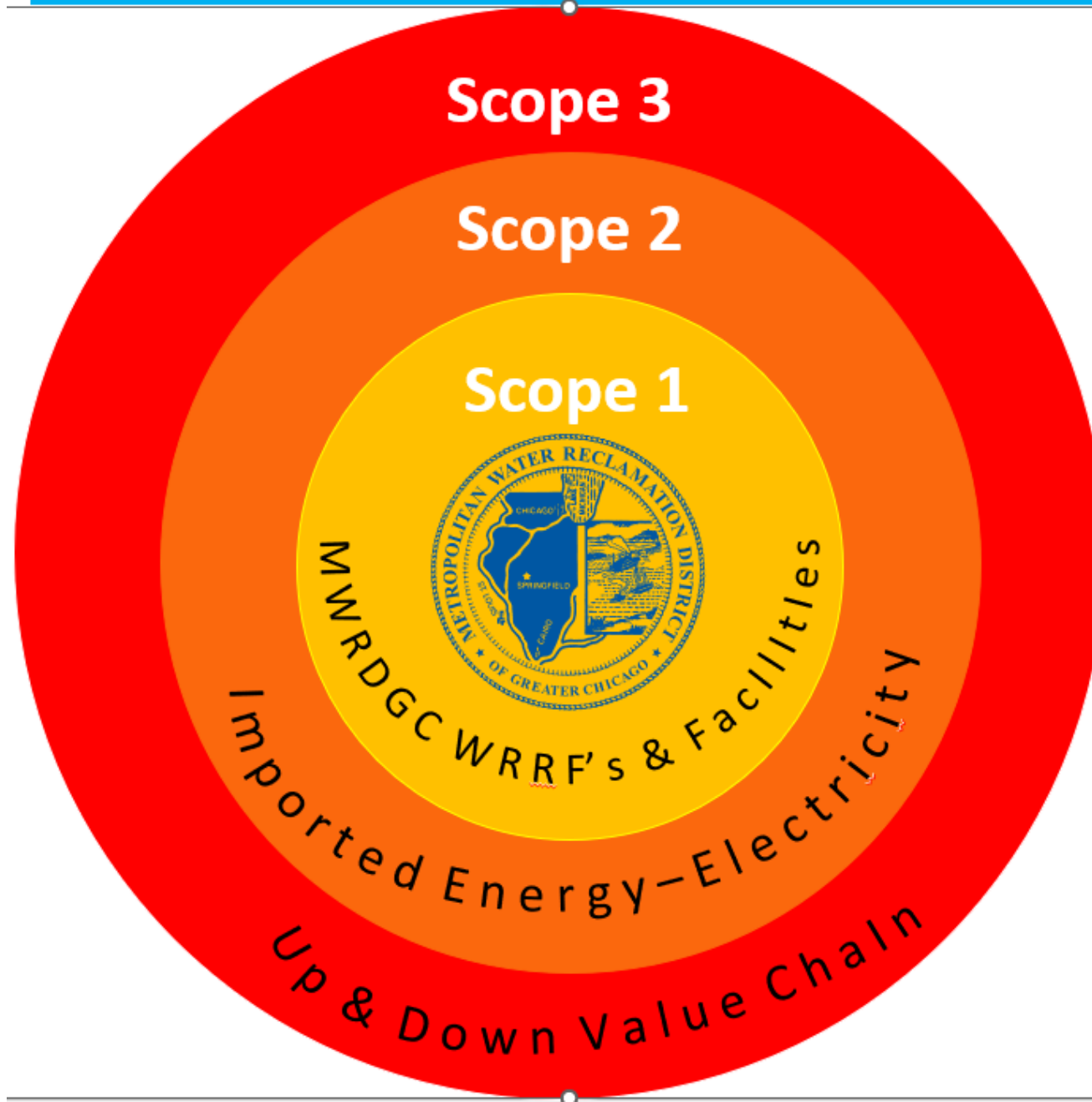
Eureka NEC180
★★★★☆ 28
35% off Cyber
\$99.99 \$154.99



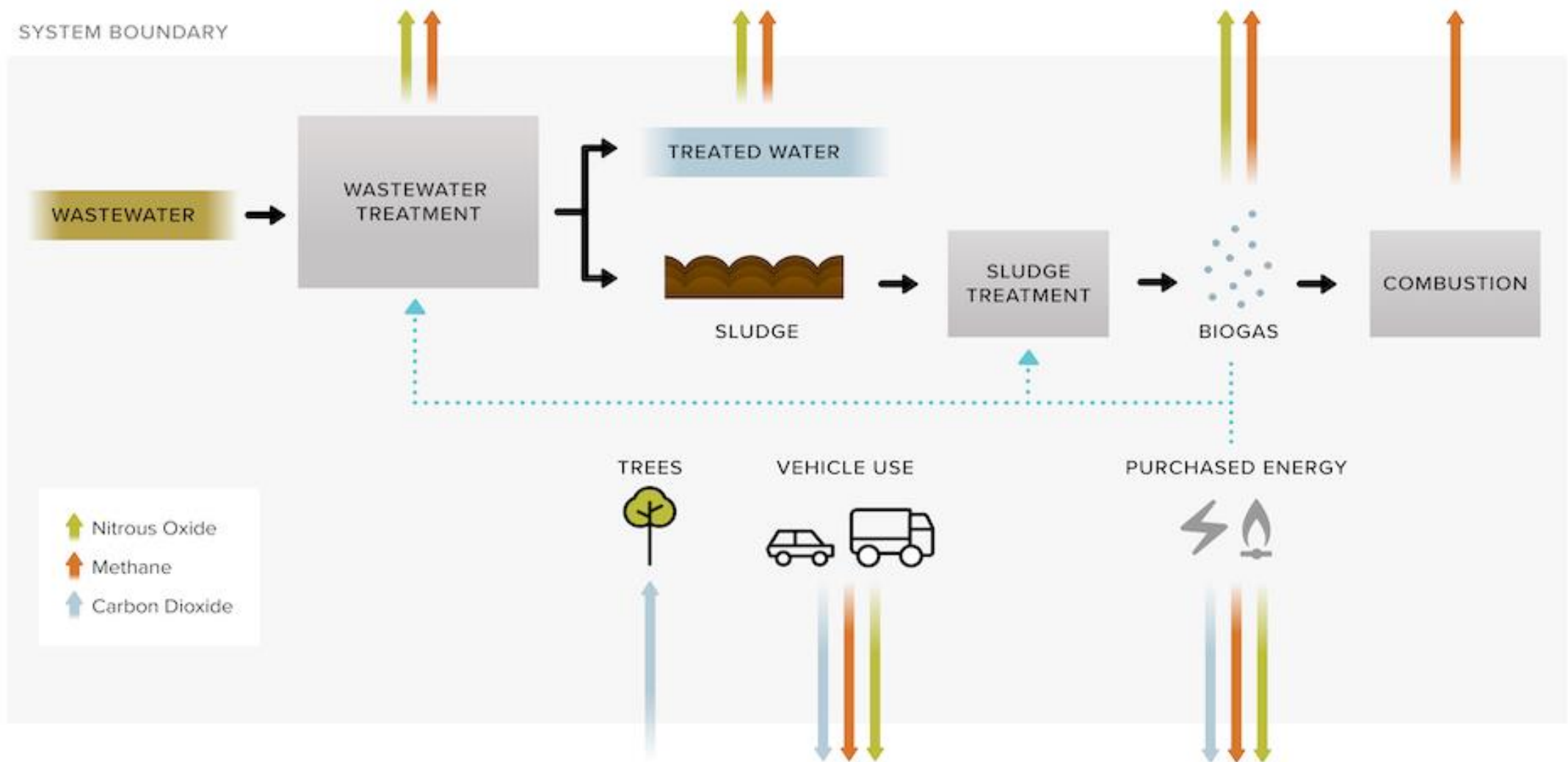
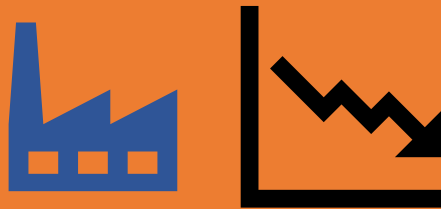
Carbon Emissions



Bilan Carbone Diagram



Carbon Emissions



Carbon Footprint Calculation: GHG emissions – Carbon sink

Expressed in CO_{2e}

GWPs

CO₂ - 1

CH₄ - 29.8/27.2

N₂O - 273

Activity level * Emission factor (or carbon sequestered)

=

GHG emissions (or sinks)

Example:

Activity level: How much energy is consumed (kWh, miles travelled, or fuel consumed etc.)

Emission factor: A coefficient that quantifies the emissions per unit of defined activity

Gram of CO₂ per liter

Gram of CO₂ per kWh

Emissions and Sinks

Scope 1 Emissions

- Natural gas use
- Biogas
- Methane from Imhoff tanks
- Nitrous oxide and methane from treatment process and treated water
- Transportation fuels – diesel and unleaded gasoline
- Solids processing areas*



Metropolitan Water
Reclamation District
of Greater Chicago



Scope 1 Sinks

- Tree carbon sequestration - forested land



Scope 2 Emissions

- Electricity use

* Will be included in 2023 calculations to be released in 2024

GHG Emission Sources Not Considered

Scope 3 Emissions – Examples

- Transmission and distribution losses of purchased electricity
- Employee travel and commuting
- Purchased goods, chemicals, equipment, and construction activities

Reasons for Not Considering Scope 3

- No direct control over these
- Most likely will be double counting if included

Example: Emissions from employee commuting are counted as part of Cook County's emissions inventory

MWRD GHG Emissions Approach

2006 IPCC Guidelines and 2019 Refinement

Local Government Ordinance Protocol (2010)
specific for wastewater utilities (California)

USEPA's Inventory of U.S. Greenhouse Gas
Emissions and Sinks 1990-2021 (2023)

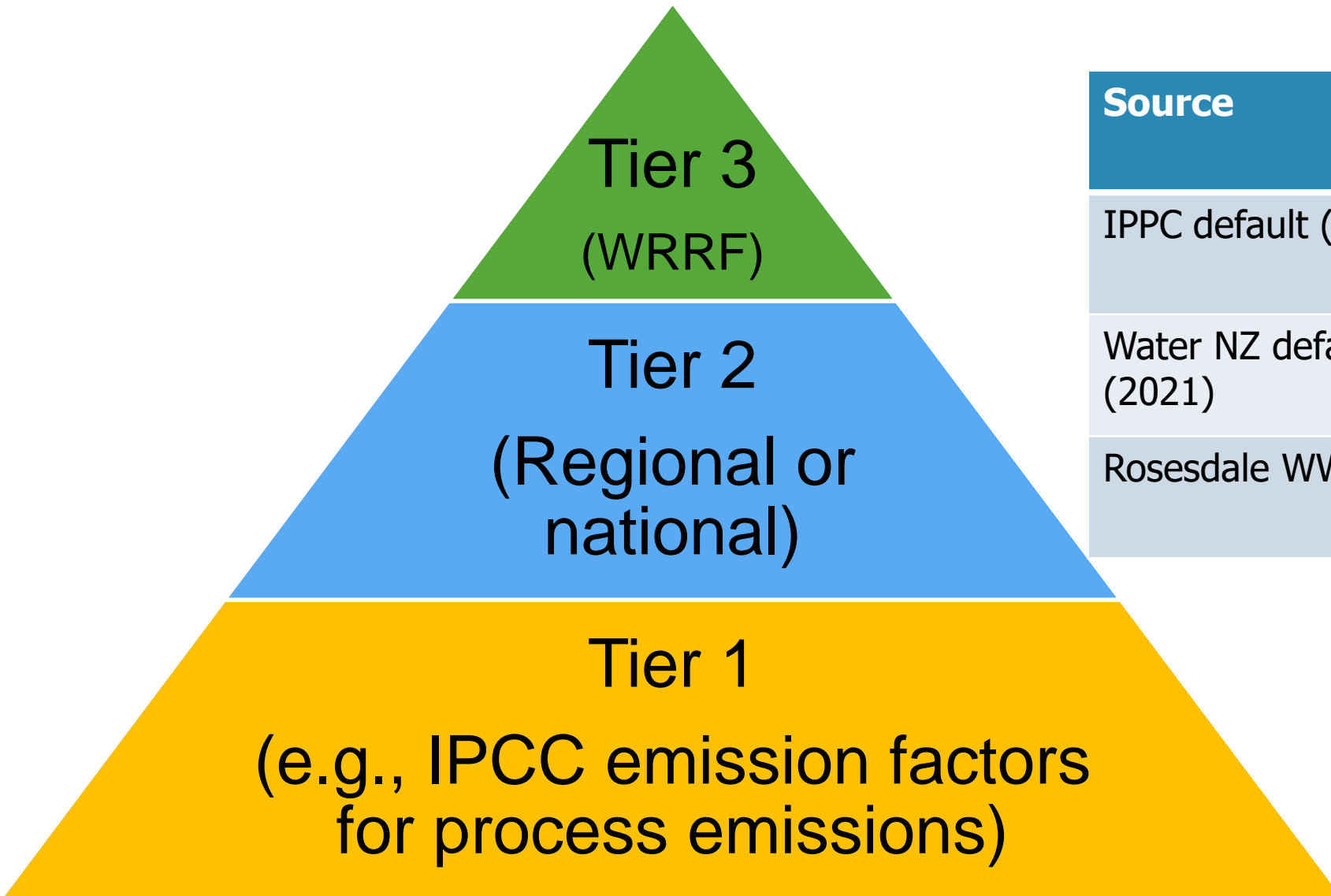
Scope

- 1 and 2 but not 3

GHGs considered

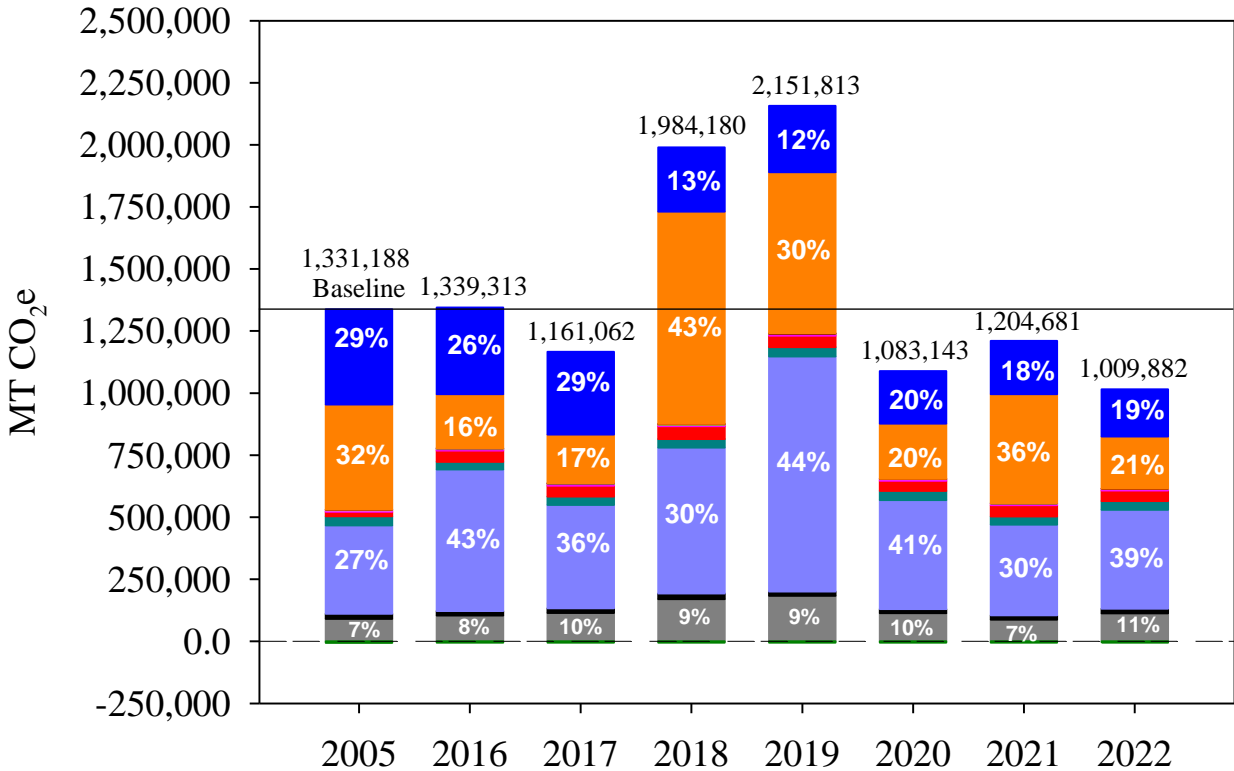
- Carbon dioxide, methane, and nitrous oxide (CO₂e)

Data precision – High uncertainty in emission factors for wastewater treatment processes



Source	EF (kg N ₂ O-N/kg N _{influent})
IPPC default (2019)	0.016
Water NZ default (2021)	0.010
Rosedale WWTP NZ	0.005

MWRDGC GHG Emissions and Carbon Footprint



- Methane - wastewater treatment
- Nitrous oxide - wastewater treatment
- Incomplete biogas combustion
- Nonbiogenic combustion
- Methane from Imhoff tanks
- Methane - treated water
- Nitrous oxide - treated water
- Unleaded fuel
- Diesel fuel
- Natural gas

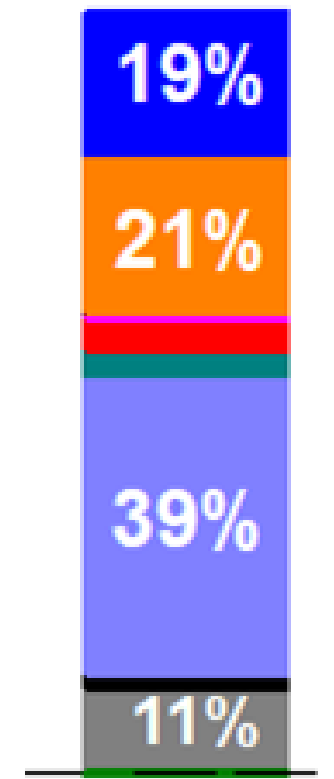
Scope 2 - Indirect Emissions

- Electricity

Offsets

- Carbon sequestered - trees

1,009,882



2022

Factors Affecting N₂O Production

N₂O production during nitrification:

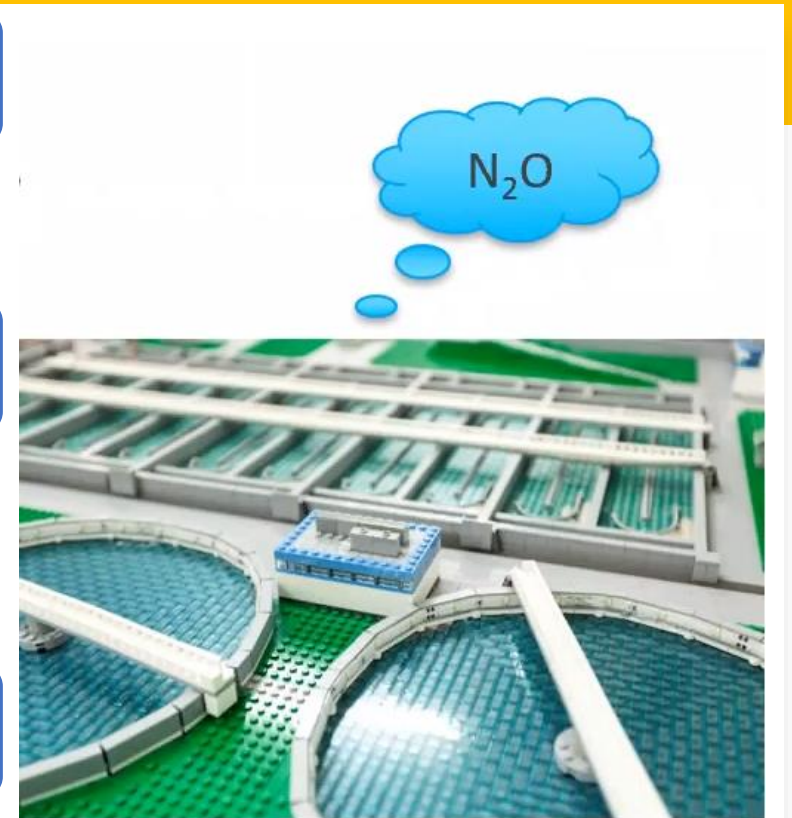
- Role of N compounds: NH₄⁺, NH₂OH, NO₂⁻, NO
- DO, pH, loading conditions

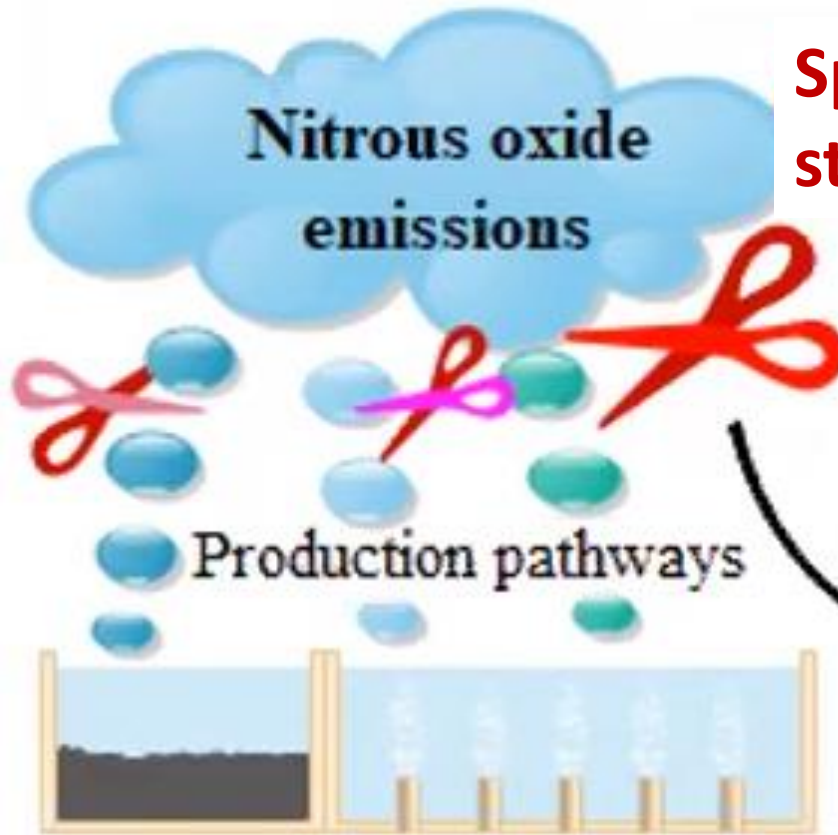
N₂O accumulation during denitrification:

- Role of carbon source, electron competition
- NO₂⁻/FNA, H₂S, Copper
- DO, pH, loading conditions

Role of environmental conditions:

- Temperature, salinity

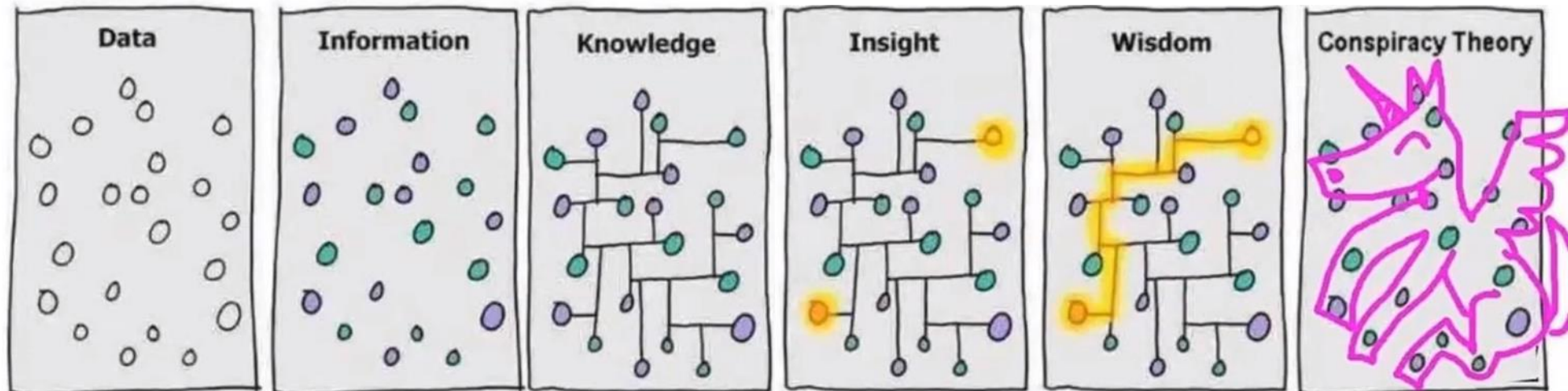




Specific mitigation strategies

- Aeration control
- Feed control
- Process optimization

- Challenges
- Limited implementations



R&D Report



N2ORisk DSS Implementation Trial for the
Metropolitan Water Reclamation District of
Greater Chicago:
N2O accounting and assessment of
Kirie and Stickney WRPs
June 2023



N2ORisk DSS Results for Kirie and Stickney WRPs 2018-2019 and 2021-2022 conditions



Pathways to Meet Carbon Emissions Reductions



Climate Goals



MWRD Targets (from 2005 Level)

Baseline Targets

2025 : 28% Reduction

2050 : 80% Reduction

Stretch Targets

2025 : 50% Reduction

2050 : Achieve Net Zero Emissions

Interim Target

2040 : 60% reduction

Scenario 1: Meeting renewable electricity targets based on Future Energy Jobs Act (FEJA) and Climate and Equitable Jobs Act (CEJA) and improved efficiencies

Scenario 2: Achieving energy neutrality

- Strategic Plan goals: Energy neutral by 2035.
- Study is in progress
- Current status : 26% energy neutral (2022)

Pathways to Meet Carbon Emissions Reductions



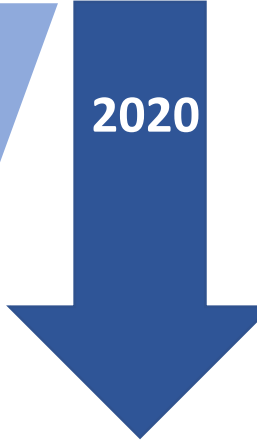
Metropolitan Water Reclamation District of Greater Chicago's Carbon Footprint Reduction Hierarchy

GHG Reduction Actions

- Operational changes
- Improve process efficiencies

GHG Emissions Reduction

2020



Pathways to Meet Carbon Emissions Reductions



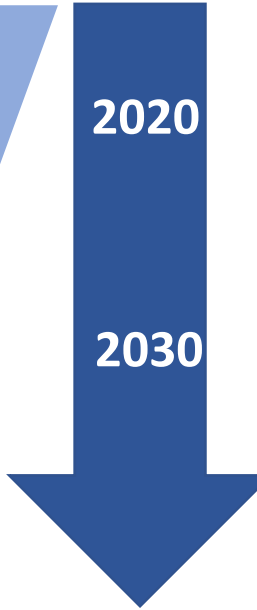
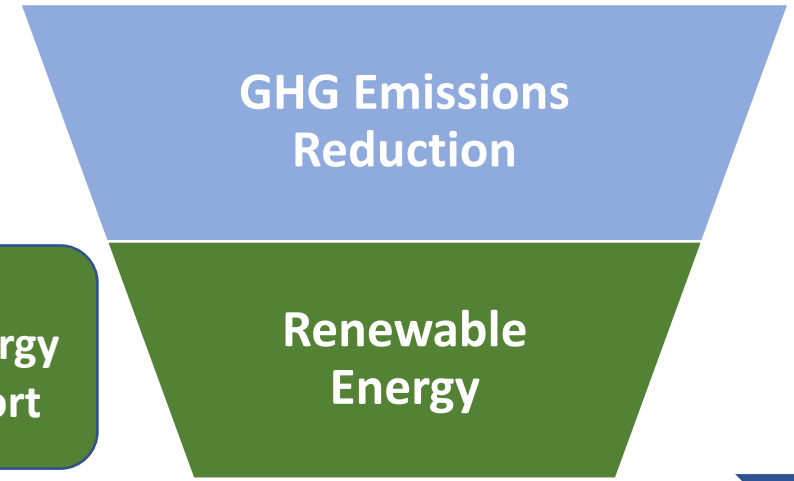
Metropolitan Water Reclamation District of Greater Chicago's Carbon Footprint Reduction Hierarchy

GHG Reduction Actions

- Operational changes
- Improve process efficiencies

Renewable Energy Measures

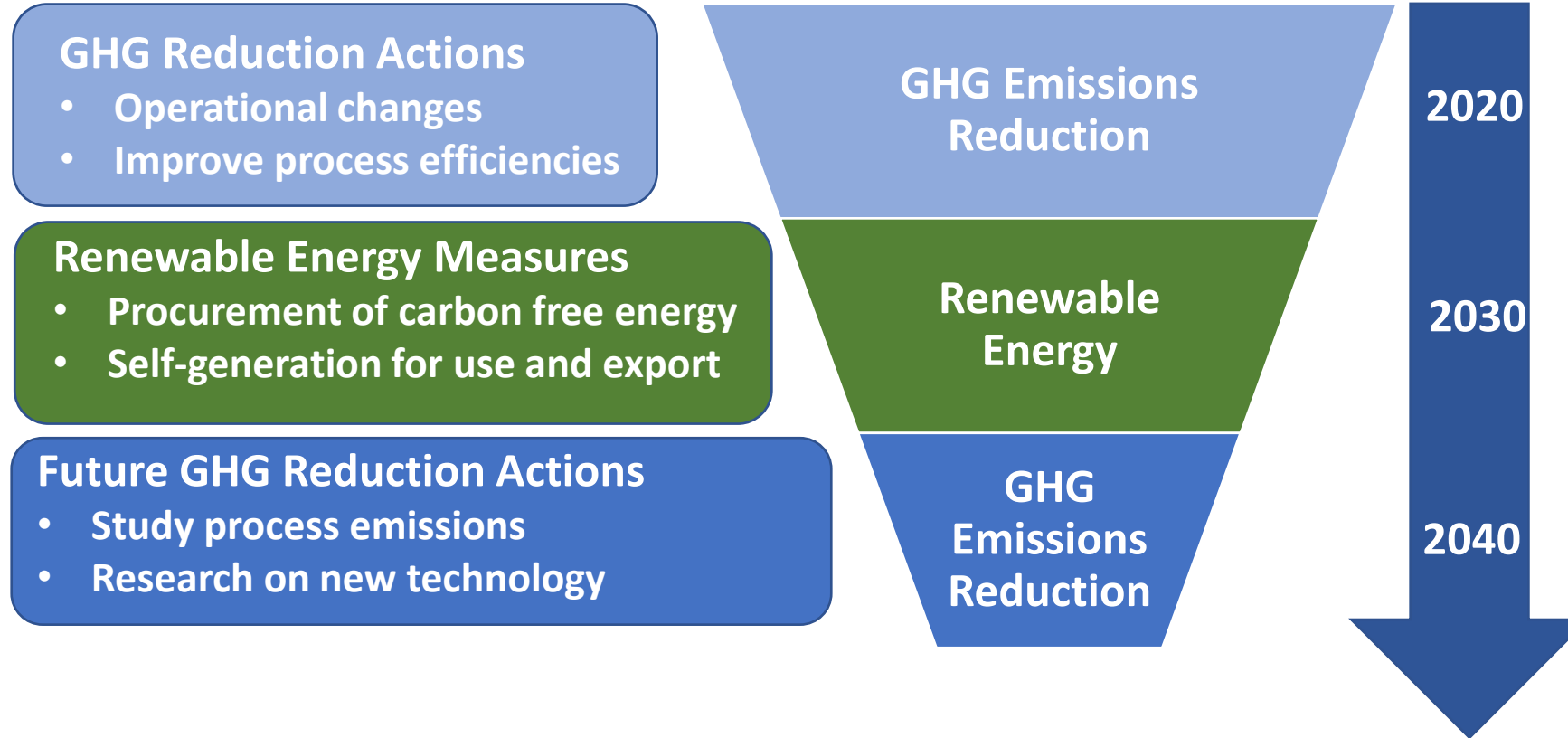
- Procurement of carbon free energy
- Self-generation for use and export



Pathways to Meet Carbon Emissions Reductions



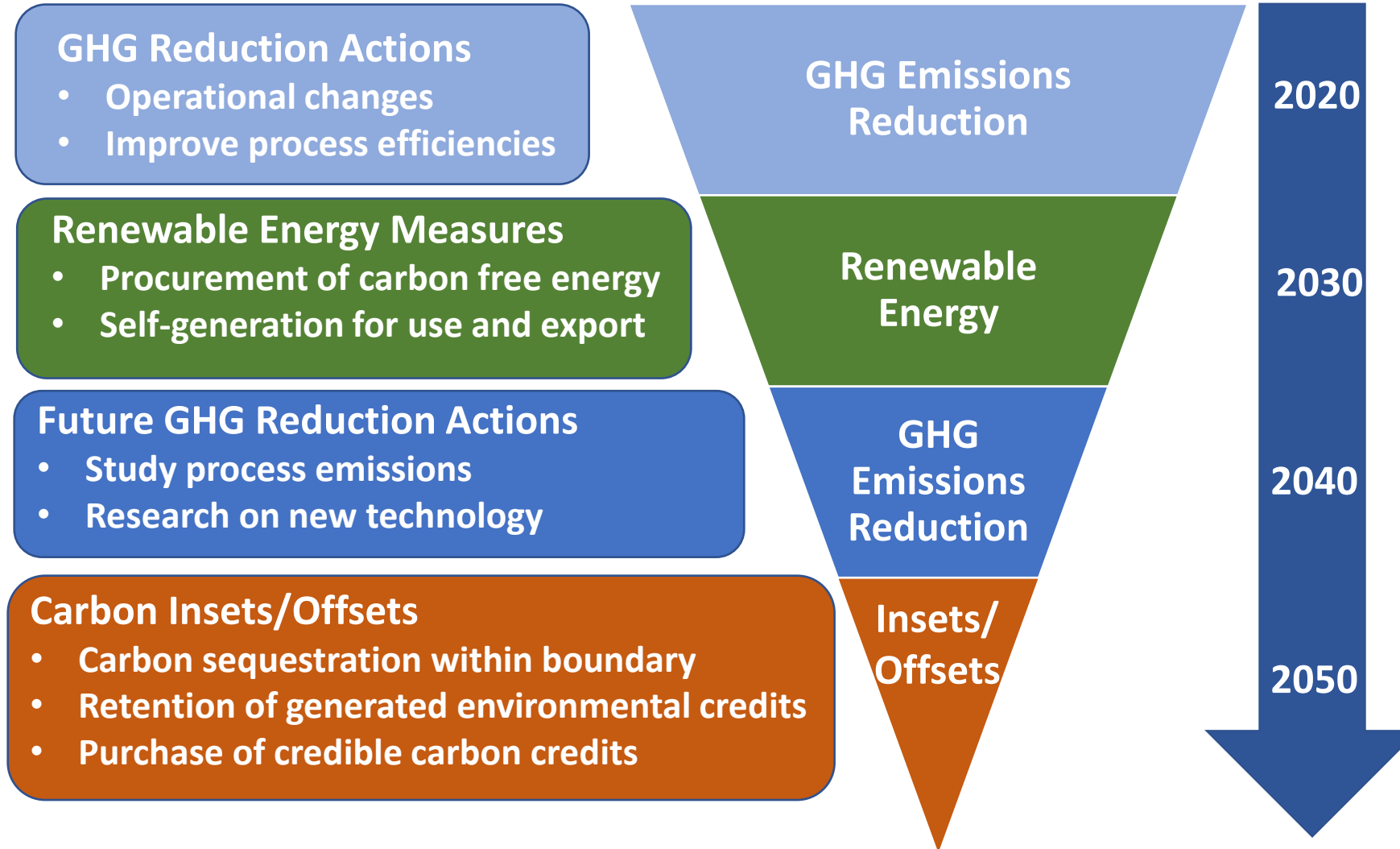
Metropolitan Water Reclamation District of Greater Chicago's Carbon Footprint Reduction Hierarchy



Pathways to Meet Carbon Emissions Reductions



Metropolitan Water Reclamation District of Greater Chicago's Carbon Footprint Reduction Hierarchy



Pathways to Meet Carbon Emissions Reductions



Tier 1 Actions to Reduce Scope 1 Direct Emissions

GHG Reduction Actions

- Operational changes
- Improve process efficiencies

GHG Emissions Reduction

Action	Anticipated Results	Deadline
Decommission Imhoff's at Stickney WRP	Reduction of approximately 36% the GHG footprint	By 2025
Install Co-Firing Boilers at Stickney and Hanover Park WRPs	Increase biogas utilization and reduce natural gas consumption (Scope 1 GHG reduction)	Both Contracts Awarded and Construction Under Way!
Continue Practice of Increasing Electric Vehicles Fleet	Reduced gasoline consumption (Scope 1 GHG reduction)	Ongoing
Explore Inflation Reduction Act (13403 & 60114)	Reduced gasoline consumption and grants to reduce GHG's	Started

Pathways to Meet Carbon Emissions Reductions



Tier 1 Actions to Reduce Scope 2 Indirect Emissions

GHG Reduction Actions

- Operational changes
- Improve process efficiencies

GHG Emissions Reduction

Action	Anticipated Results	Deadline
Installation of New Aeration Technology at Egan WRP	Reduction in electricity and inform decisions for improvement at other WRPs	By 2024 (60-day test anticipated to start within 5 weeks)
Install Turbo Blower at Egan WRP	Improved aeration efficiency and reduction in electricity	Award by Q4 2025
Pilot New Blower System at Kirie WRP	Improved aeration efficiency	Award by Q4 2025
Complete Study on Aeration System Improvements at Hanover Park WRP	Potential for reduction in electricity	By 2025 Complete!
Improve Aeration at O'Brien WRP	Reduction in electricity usage through improved efficiency (GHG reduction)	By 2030

Pathways to Meet Carbon Emissions Reductions



Tier 2 Actions to Reduce Scope 2 Indirect Emissions

Renewable Energy Measures

- Procurement of carbon free energy
- Self-generation for use and export

Renewable Energy

Action	Anticipated Results	Deadline
Install “ <i>Combined Heat and Power</i> ” unit at Egan WRP	Biogas powered electricity	Bids received and under review
Energy Neutrality Study - Ongoing	A plan for improved aeration efficiency and reduction in grid-electricity	Release end of Q4 2024
Purchase Renewable Energy Credits	Commitment to exceeding GHG reduction targets	Ongoing
Adopt Policy of Not Selling Carbon Credits Outside Fence Line	Meeting net-zero goals	By 2024
Explore Inflation Reduction Act (13101, 13102, 13103, 13701, 13702)	Achieving energy neutrality and GHG Reduction	Started

Pathways to Meet Carbon Emissions Reductions



Tier 3 Future GHG Reduction Actions

Future GHG Reduction Actions

- Study process emissions
- Research on new technology

GHG Emissions Reduction

Action	Anticipated Results	Deadline
Testing of N ₂ O Risk Decision Support System at 2 WRPs	Potential N ₂ O emissions reduction	By 2023 Completed!
Research on Decarbonizing of Wastewater Resource Recovery Facilities, USEPA, WRF, and DOE Funding	Process GHG reduction	Ongoing
Direct GHG Measurements from the MWRD Facility Processes	Accurate GHG inventory	Contract awarded!
WRF Research: Establishing Industry-Wide Guidance for Water Utility Life Cycle GHG Emission Inventories	Accurate GHG inventory Awarded to US Water Alliance	By 2025 - 2026

Pathways to Meet Carbon Emissions Reductions



Tier 4 Planned Future Actions to Meet Net-Zero Goals

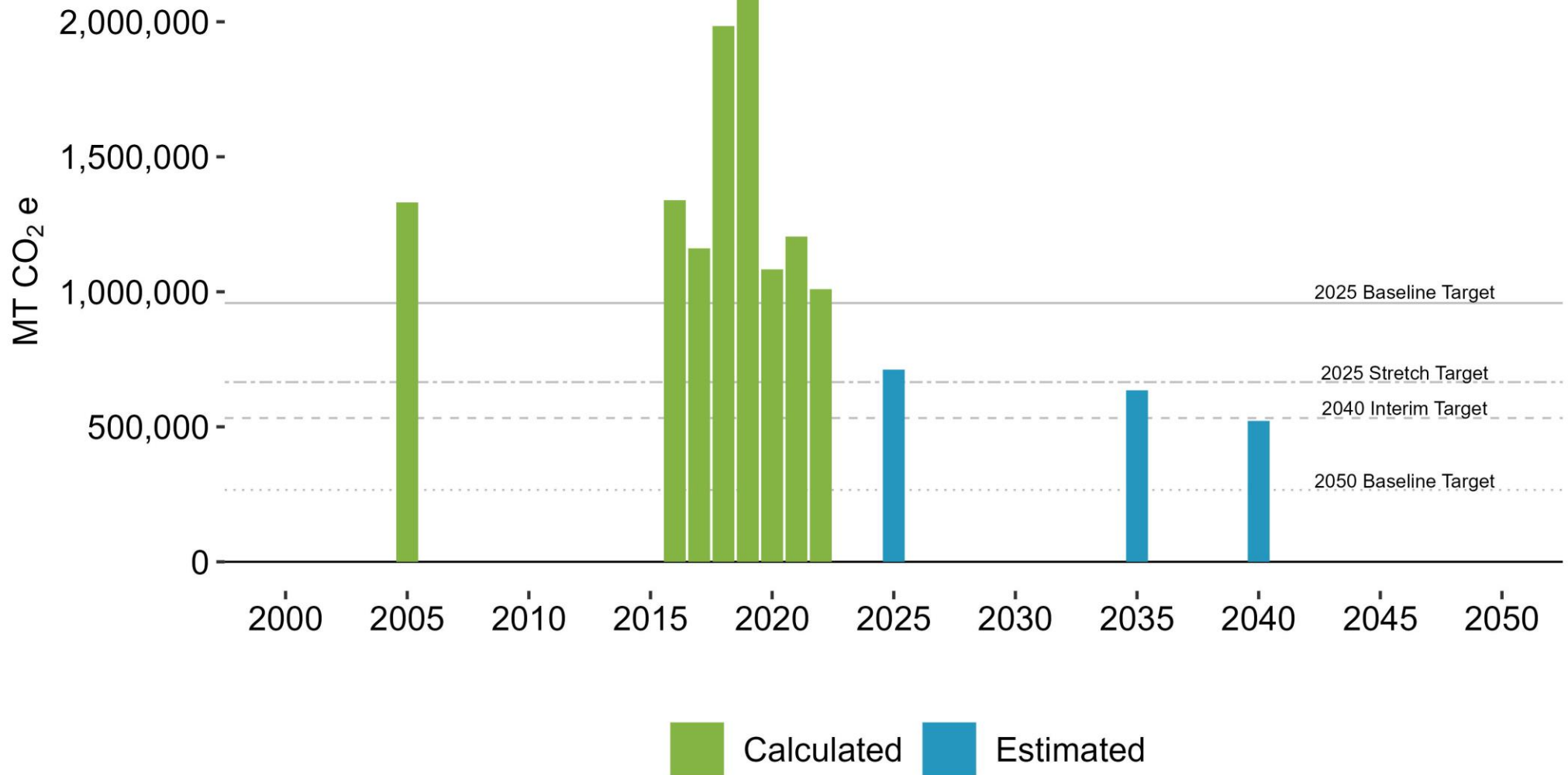
Carbon Insets/Offsets

- Carbon sequestration within boundary
- Retention of generated environmental credits
- Purchase of credible carbon credits

**Insets/
Offsets**

Action	Anticipated Results	Deadline
Conduct Pilot Study on Demonstration of Carbon Capture and Nutrient Recovery Using Algae Biofilm System	Potential for generating carbon insets as value addition to nutrient removal/recovery	By 2023 Completed!
Explore Opportunities to Expand Native Prairie Landscape on MWRD Lands	Potential for generating carbon insets and stormwater management benefits	By 2024
Participate in WRF Research: Beyond Net-Zero Carbon: Advancing Carbon Offset and Interdependencies through the Water-Energy-Food Nexus	Address knowledge gap to meet net-zero goals Awarded to Energy Resource Center - UIC	By 2025
Evaluate the Potential of Generating Carbon Insets and Offsets	Potential cost estimates	By 2030

Carbon Emissions



How to adapt to climate change may be secondary at COP28, but it's key to saving lives, experts say

SIBI ARASU

Updated Fri, December 8, 2023 at 6:33 AM CST · 5 min read



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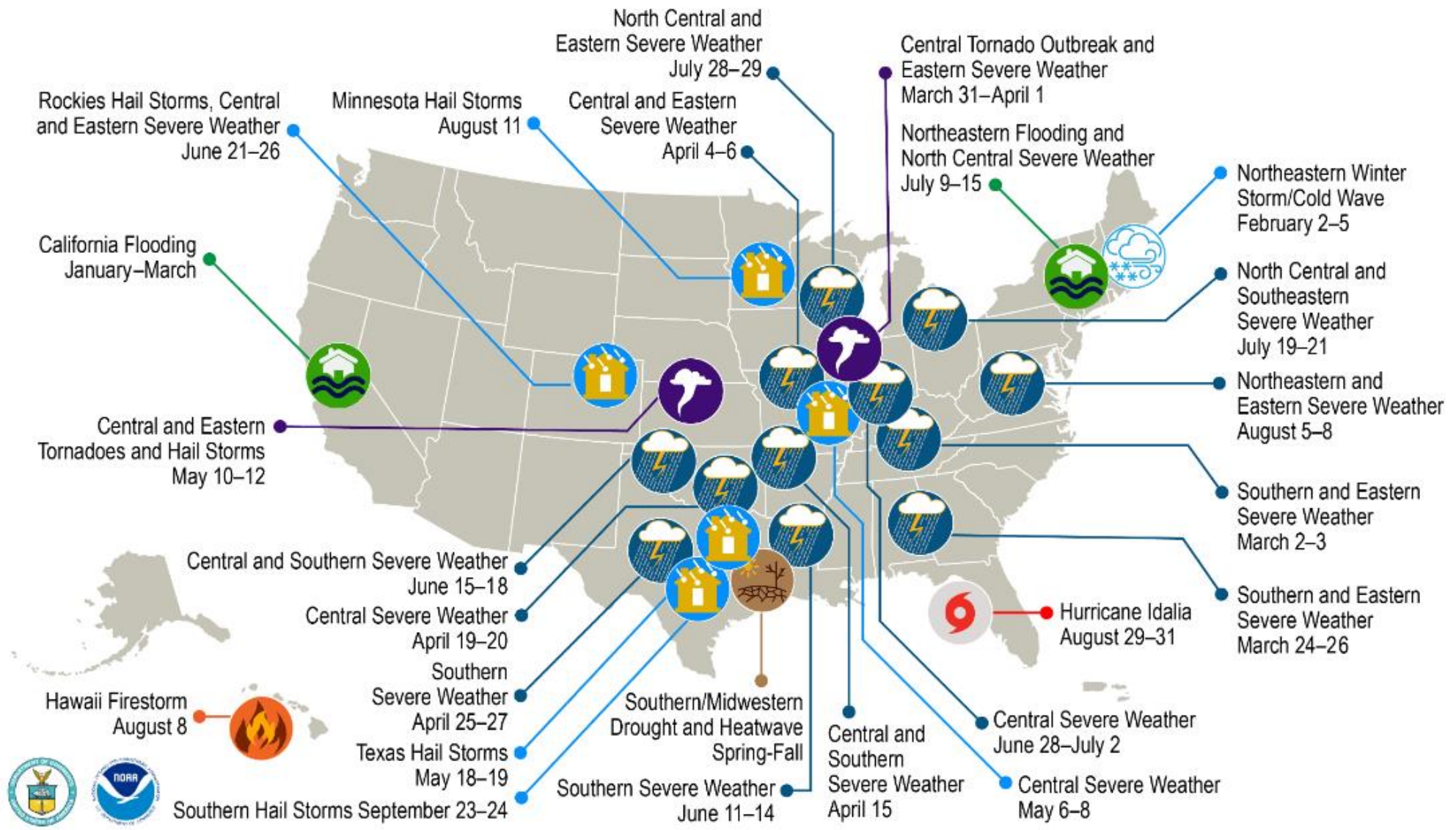
SHOP N

available
amazon

© 2023 Mars or A

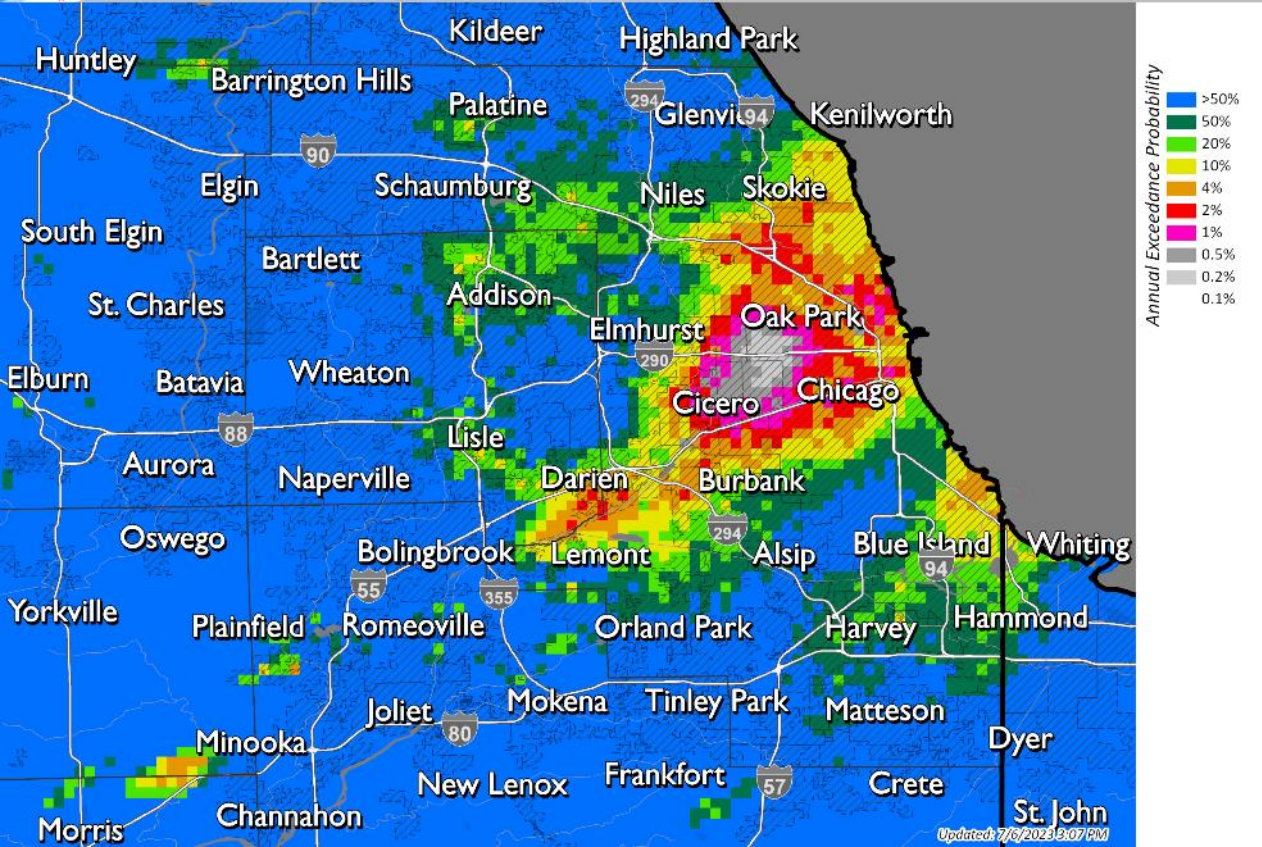
U.S. 2023 Billion-Dollar Weather and Climate Disasters

-  Drought/Heat Wave
-  Flooding
-  Hail
-  Hurricane
-  Severe Weather
-  Tornado Outbreak
-  Wildfire
-  Winter Storm/Cold Wave

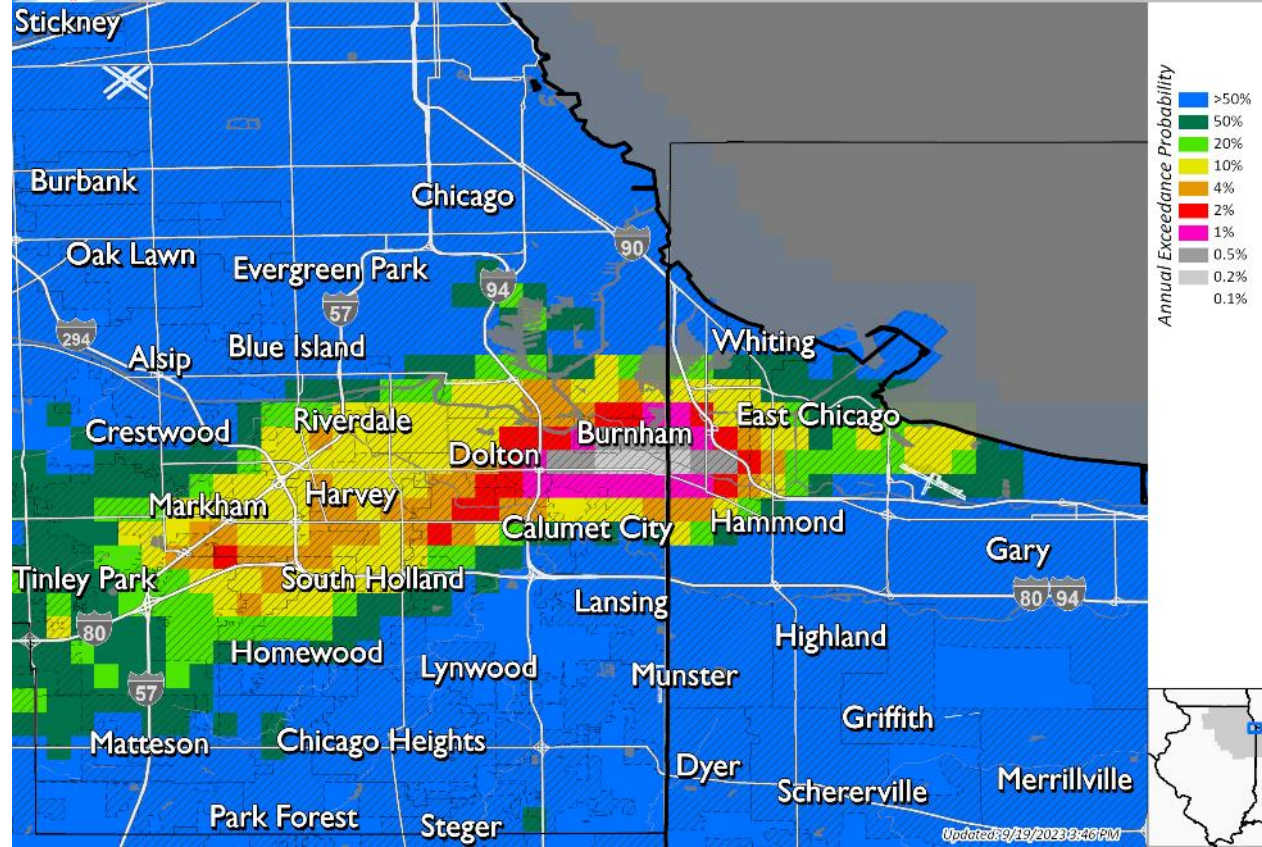


This map denotes the approximate location for each of the 25 separate billion-dollar weather and climate disasters that impacted the United States through November 2023.

July 2, 2023, Heavy Rainfall Event
 18-hour rainfall annual exceedance probability ending July 2 at 7:00 PM



September 17, 2023, Heavy Rainfall Event
 12-hour Rainfall Annual Exceedance Probability ending 9:00 PM



Recent Extreme Precipitation Events

THE WALL STREET JOURNAL , August 30, 2023.

Chicago Is Spending \$3.8 Billion to Fight Flooding. It Might Not Be Enough. Massive tunnel-reservoir system could struggle to handle the biggest rains



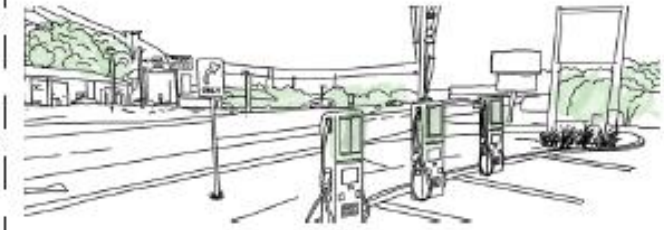
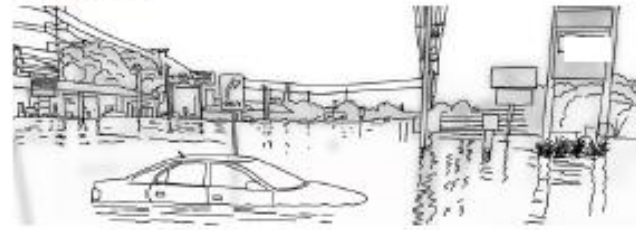
Adaptation for Building Regional Resilience

Climate Hazards and their Potential Impacts to People, Assets, and Infrastructure

- Heat and Public Health
- Heat and Water Quality
- Flooding and Homes
- Flooding and Infrastructure
- Flooding and Transportation
- Flooding and Water Quality
- Drought and Water Supply
- Air Quality and Public Health

2021

FLOODING



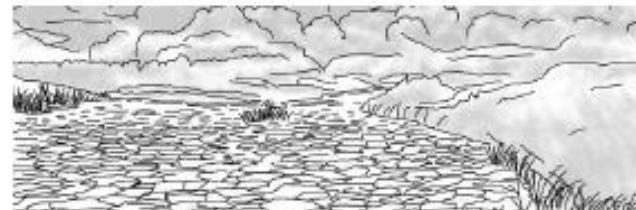
HEAT & HEALTH

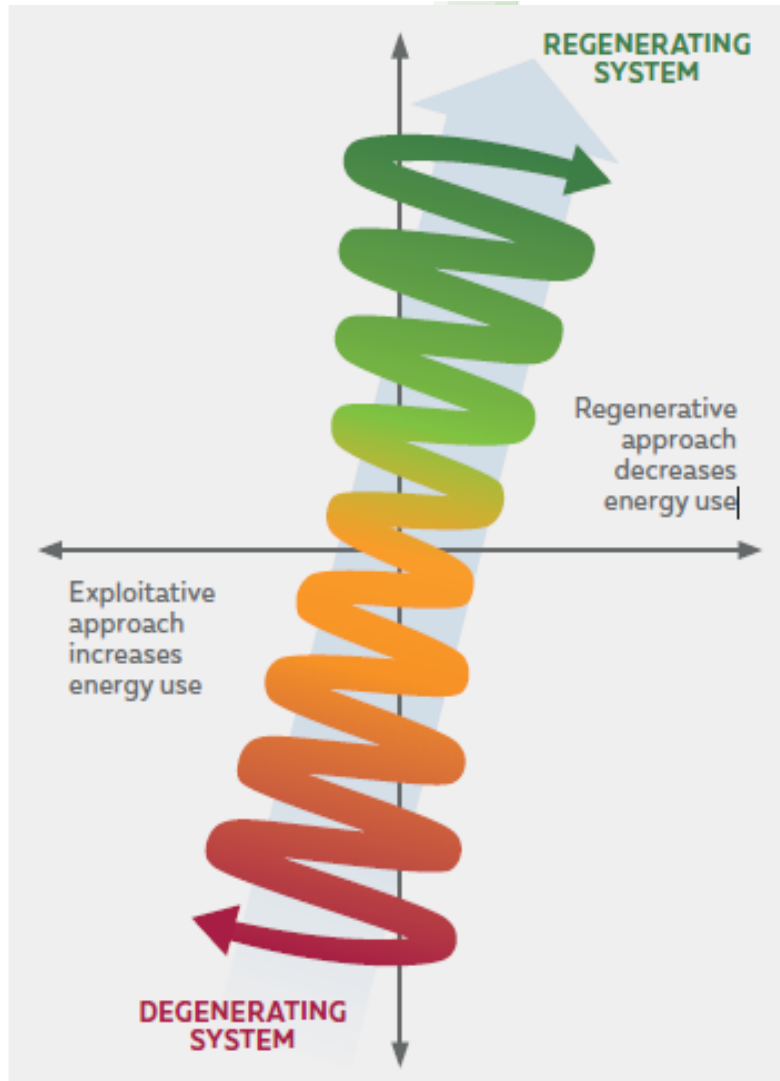


AIR QUALITY



DROUGHT & WATER SUPPLY





The Regenerative Design Framework

- **REGENERATIVE**
Appropriate participation and design as nature
- **RESTORATIVE**
Humans doing things to nature
- **SUSTAINABLE**
Neutral point and not doing any more damage
- **CONVENTIONAL PRACTICE**
Compliant with regulations

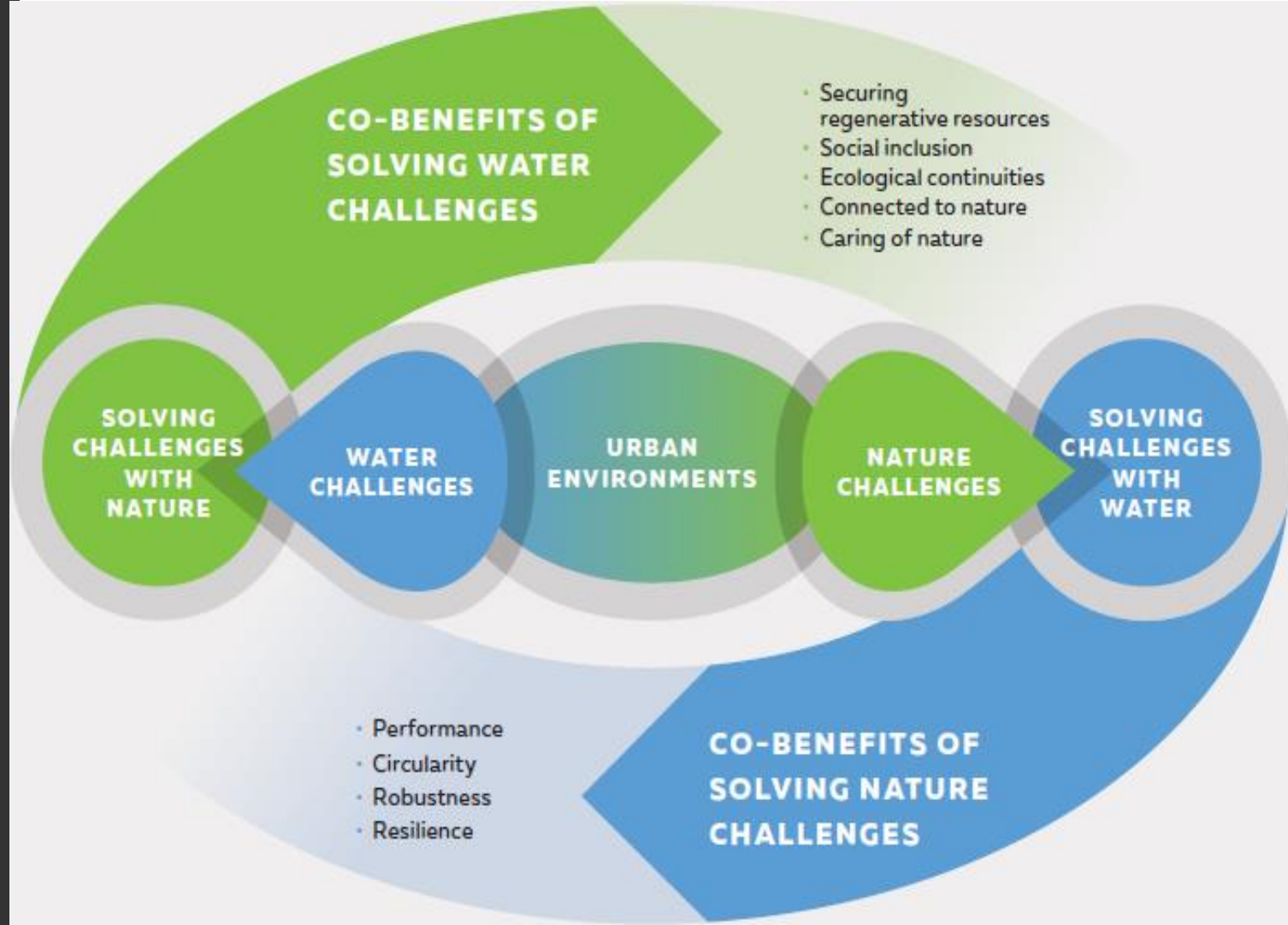
Image Adapted From: Regenesi Group

Working With Nature

WE CANNOT PROTECT SOMETHING WELL -

IF WE ARE NOT EMOTIONALLY CONNECTED TO IT

--- Sofia de Meyer
CE Thought Leader



Stormwater Partnership Program Overview

Green Infrastructure Partnership Program (GIPP)



Flood-Prone Property Acquisition Program (FPPA)



Stormwater Partnership Program (SPP)

SPP Conceptual Projects

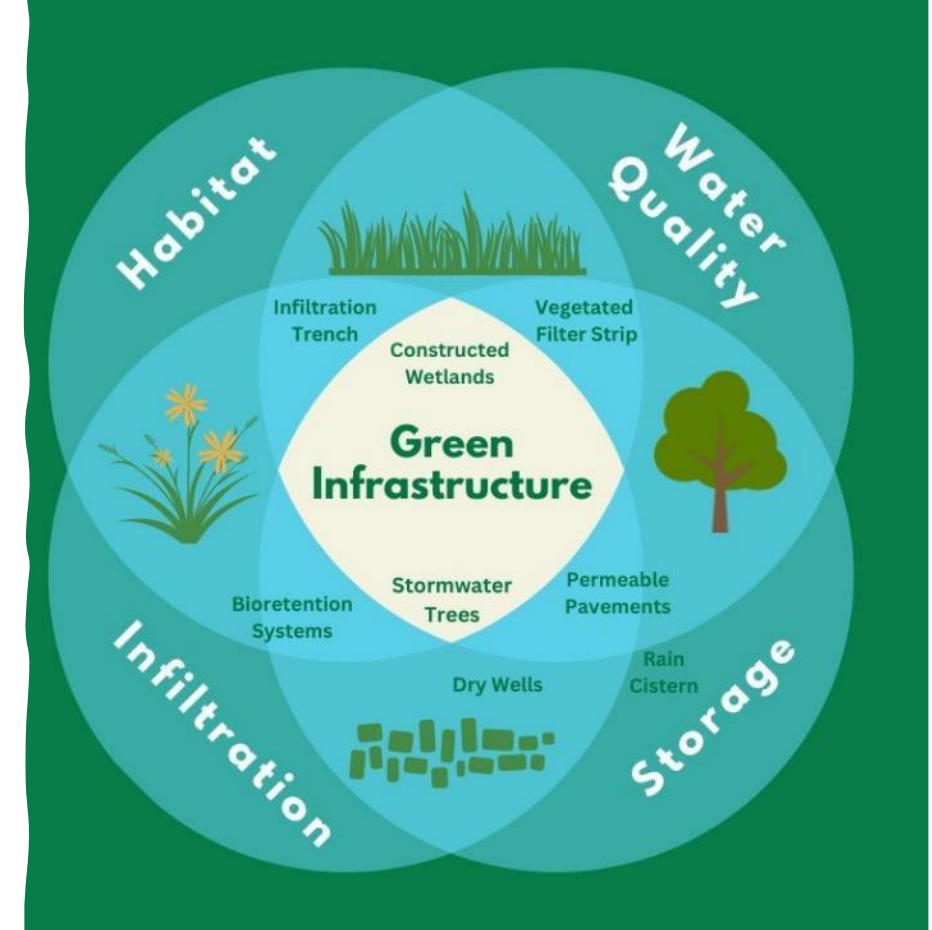


SPP Design & Shovel Ready Projects



Managing Stormwater Using Green Infrastructure

- Why use GI:
 - Supplement existing infrastructure and reduce burden on sewer system
 - Store and slow down stormwater runoff
 - Other social and economic benefits



SOCIAL BENEFITS

Facilitates Social Capital

Beautifying Neighborhoods



Healthy Community



Recreational Amenities



ECONOMIC BENEFITS

Improves Residential Property Values

Property Values



Lowering Heating and Cooling Cost



Boosting Economic Development



Stormwater Program Overview

Program Component	Current # of Projects	Structures Protected/Removed	Construction/Acquisition Cost (\$ Million)	MWRD Cost (\$ Million)
Regional Stormwater Projects	26	3,645	\$343	\$277
Local Stormwater Projects	77	>10,000	\$298	\$189
Green Infrastructure Projects	123*	3,595	\$125	\$50
Flood-Prone Property Acquisitions	19	175	\$42	\$31
Total	245	>18,000	\$808	\$547

*Includes all 34 Space to Grow projects completed under the pilot (4) and initial (30) IGAs

Equity in Stormwater Management

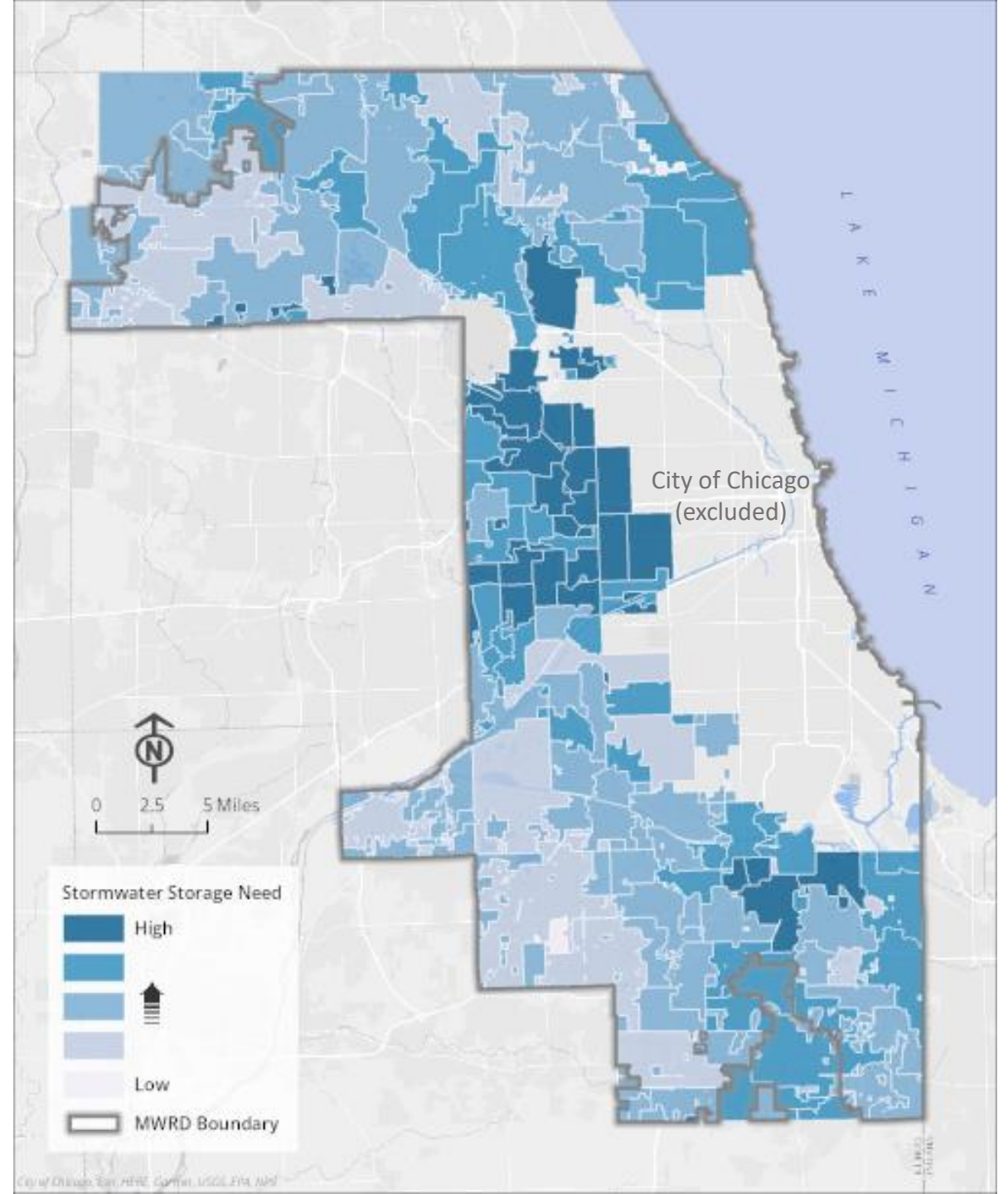
MWRD considers the environmental justice aspects of climate change by:

- Promoting Green Infrastructure, Flood-Prone Property Acquisition, and Local Stormwater Project partnership opportunities
- Performing Preliminary Engineering, Final Design, and Construction of projects in EJ areas (e.g. Robbins Stormwater Park projects), and
- Utilizing a new Volumetric Approach for establishing priority areas for project development.



Volumetric Approach to Stormwater Master Planning

- Estimate stormwater storage need by municipality.
- Adaptive approach to planning to prioritize need and track progress



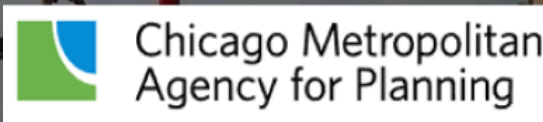
Continue to Foster Locally Led Strategies and Projects that Work

Leverage Available Resources

Develop and Advance Strategic Partnerships

Stormwater Impacts to People, Assets, and Infrastructure

- Homes and Businesses
- Critical Infrastructure
- Transportation
- Water Quality



Overarching Actions to Build Regional Climate Resilience



Community Engagement and Education

- Collaborate with CMAP/Metropolitan Mayors Caucus/City of Chicago on Regional Resilience



Modernizing Telecommuting Practices and Rules

- Enact policies to reduce unnecessary travel
- Implement technologies to support minimized travel



Reducing Emissions for Business Travel

- Budget for purchasing carbon offsets for necessary travel
- Expand employee access to charging stations



Employee Recognition

- Recognize individuals for their own actions to reduce overall greenhouse impacts



Enhance Carbon Sinks

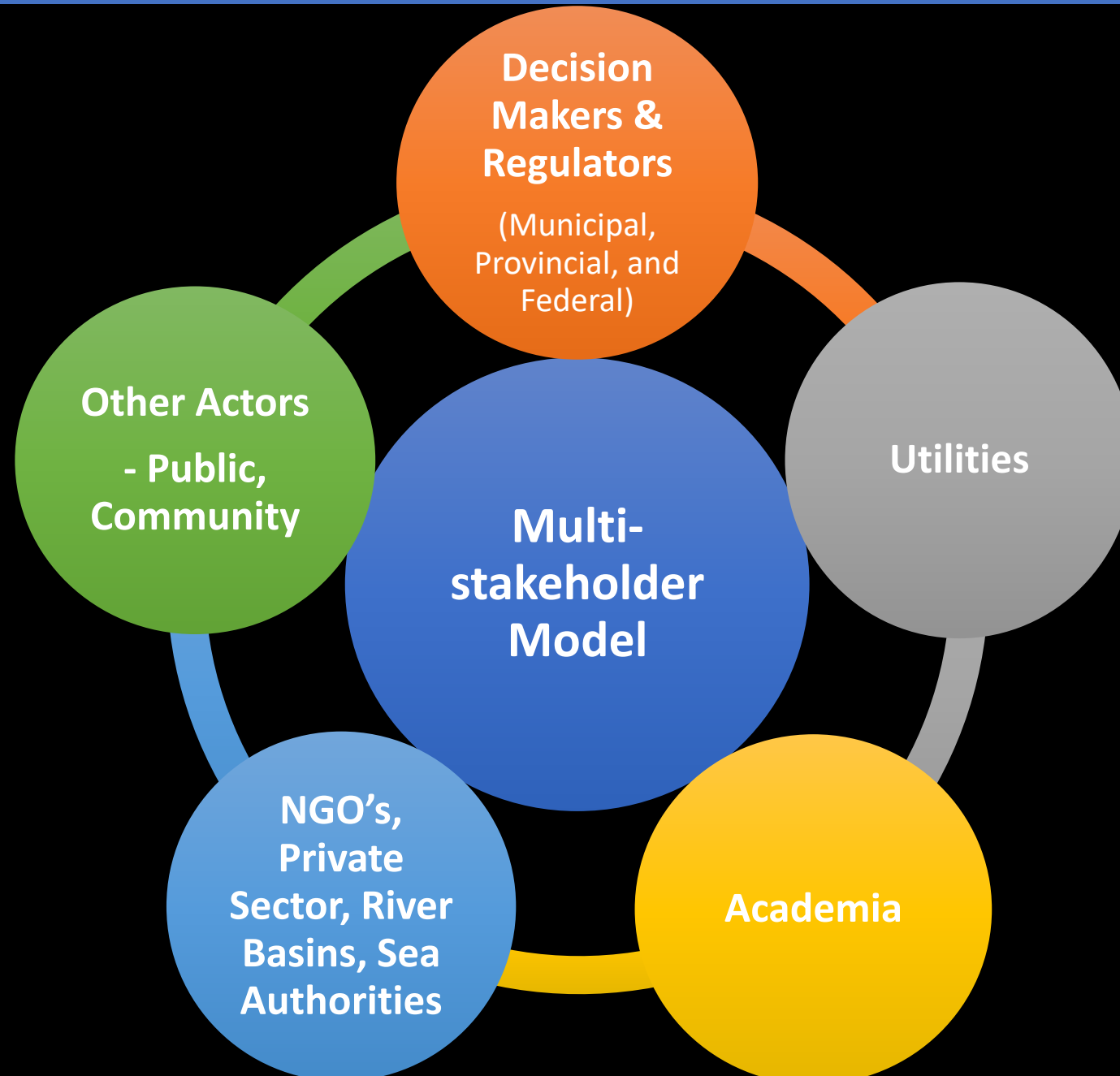
- Continue programs such as restore the canopy and biosolids distribution



Procurement of Low Carbon-intensity Materials

- Modernize specification for lower carbon alternative products

Global Actions: UNESCO's Megacities Alliance for Water and Climate (MAWaC)





How Can You Help?

Reduce Energy Consumption and Consider Solar Energy

Transportation Choices

Waste Management

Water Conservation

Tree Planting and Green Spaces


Sustainable Living and Food Choices

Advocate for Change

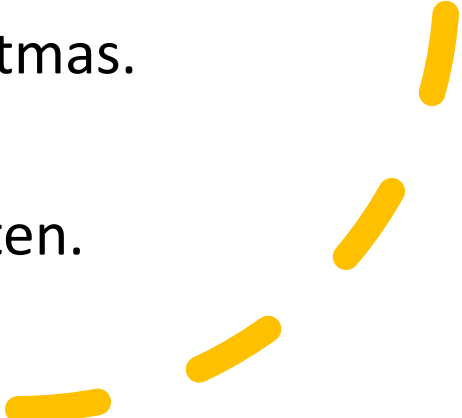
Educate Yourself and Others

Community Engagement

Vote for the Environment

A large orange circle on the left side of the slide, partially cut off by the edge.

Some Example Pledges from Public to Fight Climate Change

- I pledge to buy less new items.
 - I pledge not to use tap water to water my plants inside the house or the garden.
 - I pledge to conduct a Parent Talk at my kids' school on importance of water to tackle climate change.
 - I pledge to bring climate action from my professional life to my personal life.
 - I pledge to decrease the temperature of my thermostat and hot water at home to save energy.
 - I pledge to take short showers instead of baths to save water.
 - I pledge to have a minimum impact Christmas.
 - I pledge to plant a tree.
 - I pledge to take public transport more often.
 - I pledge to buy sustainable products.
- 
- Four short, curved yellow lines in the bottom right corner, arranged in a roughly diagonal pattern.



Metropolitan Water Reclamation District of Greater Chicago

For More Information



<https://mwrdd.org/what-we-do/climate-action-plan>

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