FRESHWATER COLLABORATIVE OF WISCONSIN - IMPLEMENTATION PLAN

On October 25, 2018, the US Department of Energy and the US Environmental Protection Agency announced the Water Security Grand Challenge to "incentivize new technologies aimed at solving one of the most important challenges of our time – providing access to clean, safe and secure water." Meeting this challenge is predicted to be a $23 trillion problem in the next 20 years. Water challenges can be broadly categorized into challenges to **supply**, challenges of **pollution**, managing use or **demand,** and **infrastructure** challenges. However, depending on context tackling these challenges requires a wide variety of solutions. The Freshwater Collaborative of Wisconsin will address 10 Grand Water Challenges, which will be phased in at campuses across the UW-System over the next three biennial budgets. Solutions to each challenge will be underpinned by five cross cutting themes of fundamental research, technological innovation, workforce development, informed policy and law, and responsible resource management. This initiative will encompass both research and education and the educational offerings span continuing, professional education, undergraduate and graduate degree programs, specialized training opportunities, and general public awareness.

10 GRAND WATER CHALLENGES

Phase 1: 2019-21 Budget	Lead Institutions	Challenges	Solutions	Benefits	Stakeholders	Example Projects
Agricultural Water Management	UW-Green Bay, UW-Madison, UW-Platteville, UW-River Falls, UW- Stevens Point	Irrigation over-withdrawal; Nutrient, pesticide, herbicide runoff and contamination of groundwater; Hormone and antibiotic release to the environment, Farm policy impacts	Use of innovative sensor technologies; Development of new "best practices"; Efficient water use; Efficient nutrient/pesticide application; Antibiotic minimization; skilled workforce; technology innovation; effective incentive systems & policies	Lower pumpage, fertilizer and antibiotic costs; reduced contaminant loading to watersheds, improved fisheries; safer drinking water; improved resilience; healthy productive soils; increased efficiencies of production and profit margins	Farmers and property owners; Lake owner associations; Recreational water users; Rural municipal water suppliers; Private well owners	1) Widespread drinking water contamination in NE Wisconsin due to CAFOs and improperly maintained septic systems 2) Ground and surface water duress in the Central Sands from overpumping and nitrate contamination 3) impact of US Farm Bill policies
Industrial Water Engineering and Technology	UW-Madison, UW-Milwaukee, UW-Platteville	Access and Risk, Efficiency, Discharge and Treatment, Reuse, Workforce, reducing virtual water use	Skilled Workforce, Sensors, Data Analysis, Integrated Systems, Reuse and Filter Technologies, Technology Innovation, Infrastructure Improvements, Intelligent/Integrated Systems and Smart Infrastructure Improvements	New intellectual properties, lower costs for businesses, guaranteed access to supply, skilled talent, entrepreneurial water community, attract new businesses to state, reduce business risk	Manufacturers, Water Technology Companies, Utilities, Municipalities	- Foxconn Industrial Water-Use and Integrated, Connected Water Systems - Training Engineers for Water Tech Industry - elimination of Beneficial Use Impairments
Water Quality, Safety and Emerging Contaminants	UW-Eau Claire, UW-Madison, UW-Milwaukee, UW-Oshkosh, UW-Parkside, UW-Stevens Point, UW-Whitewater	Public Health, Lead Poisoning, Legacy Contamination, Emerging Contaminants and Nanomaterials, Nutrient Contamination, Well Contamination, Surface Water Contamination, Safe Drinking Water Compliance, Effective Treatment Techniques	Better Indicators of Ecosystem Health, Identification of Harmful Contaminants, Improved Land-Management Practices, Environmentally Friendly Chemicals/ Pharmaceuticals/Nanomaterials, Improved Treatment Technologies and Infrastructure, Best-Management Practices at Industrial Plants and Hospitals, Reduced Urban Source Pollution, Improved Metals Testing	Drinkable, Swimmable, Fishable Waters; Less Lead Ingestion, Higher Water Quality; Elimination of Fish Consumption Advisories; Increased Waterfront Property Values, Reduced Beach Advisories	Public Health Officials, Pharmaceutical Companies, Hospitals, Utilities, Water Technology Companies	- Curtailing Impacts of Contaminants in Wisconsin Surface Waters - Development of "Green" Nanomaterials for Industrial Users and Sold by Water Tech Industry - Mitigation of Lead in Drinking Water
Great Lakes Management, Protection and Restoration	UW-Green Bay, UW-Milwaukee, UW-Oshkosh, UW_Parkside, UW-Stevens Point, UW-Superior	Legacy Contamination, Emerging Contaminants, Nutrient Contamination, Loss of Habitat, Invasive Species, Water Levels, Fisheries, Restoration & Protection policies	Modeling Great Lakes Dynamics and Ecosystems, Eliminating Introduction of Harmful Contaminants, DNA Sequencing of Crucial Species, Mapping Habitat, Informing Land Management Practices to Reduce Nutrient Loading, Real time integrated observing and monitoring systems	Swimmable, Fishable, Drinkable Water; Increased Property Values on Great Lakes Waterfronts; Mitigation of the Impacts of Lake Level Fluctuation; Increased Recreation and Tourism Opportunities; Improved Recreational Fish Stocking Practices; Protection Against Invasive Species	Recreation and Tourism, Shipping Industry, Municipalities	- Restoring the Green Bay Estuary - Enhancing Recreational Fisheries in Western Lake Michigan Harbors - Economic Enhancements of Great Lakes Waterfronts
Phase 2: 2021-23 Budget	**Lead Institutions**	**Challenges**	**Solutions**	**Benefits**	**Stakeholders**	**Example Projects**
Water Infrastructure: Collection, Distribution, Treatment	UW-Green Bay, UW-Madison, UW-Milwaukee	Costly Water and Sewer Main Maintenance and Replacement, Aging Distribution System Components like Pumps, Valves and Hydrants, Non-Revenue Water Loss, Reservoir and Tank Maintenance, Overflows, Aging Treatment Plants/Filter Beds, Missized Pumps	Skilled Workforce, Sensors, Data Analysis, Integrated Systems, Asset Management, Reuse and Filter Technologies, Technology Innovation, Economically Viable Infrastructure Improvements and Replacement, Materials Advancement, Capacity Analysis	Safe Drinking Water, Swimmable and Fishable Waters, Reduced Environmental Impacts, Increased Waterfront Property Values, Reduced Flooding and Basement Backups, Fewer Overflow Events, Fewer Water Main Breaks	Municipalities, Utilities, Water Technology Companies, Engineering Consulting Firms, Public Health Officials	- Reducing Flooding in Wisconsin Communities After Massive Rain Events - Study of Adequate Water Storage - Assessment of Emerging Lining Technologies
Water Business, Law and Finance	UW-Madison, UW-Milwaukee, UW-Stout, UW-Whitewater	Informed Operations Management, Utility Rate Management, Success Rate of Water Technology Start-Ups, Financing Critical Infrastructure	Capital Finance Solutions, Sustainable Utility Rates, Business Expansion, Start-Up Assistance, Tech Transfer	Water Manufacturing Industry Growth, Economic Investment, More Water Savvy Executives, Job Creation, Cost Management	Water Company C-Suites, Utilities, Contractors, Engineering Consulting Firms, State and Federal Agencies	- Assessing the Viability of Public-Private Infrastructure Financing Mechanisms - Best Practices in Capital Planning and Asset Management
Watershed Management and Restoration	**Rivers:** UW-Eau Claire, UW Green Bay, UW-LaCrosse, UW-Parkside, UW-Platteville, UW-Stevens Point, UW-Stout, UW-River Falls, UW-Whitewater . **Inland Lakes:** UW-Madison, UW-Parkside, UW-Stevens Point, UW-Stout, UW-Whitewater . **Groundwater:** UW-Madison, UW-Milwaukee, UW-Oshkosh, UW-Parkside, UW-Stevens Point	Legacy Contamination, Emerging Contaminants, Nutrient Contamination, Loss of Habitat, Invasive Species, Water Levels, Fisheries	Modeling Surface Water Dynamics and Ecosystems, Reducing Introduction of Harmful Contaminants, DNA Sequencing of Crucial Species, Mapping Habitat, Informing Land Management Practices to Reduce Nutrient Loading	Swimmable, Fishable, Drinkable Water; Increased Property Values Near Waterfronts; Mitigation of the Impacts of Lake Level Fluctuation; Increased Recreation and Tourism Opportunities; Improved Fisheries; Improved Recreational Fish Stocking Practices; Protection Against Invasive Species; Mitigating Algal Blooms	Recreation and Tourism, Shipping Industry, Municipalities	- Protecting the $1 Billion Recreational Fishery in the Driftless Zone - Reducing Algal Blooms in Wisconsin's 15,000 Inland Lakes - Mitigating Impacts to Health of Groundwater Depletion
Phase 3: 2023-25 Budget	**Lead Institutions**	**Challenges**	**Solutions**	**Benefits**	**Stakeholders**	**Example Projects**
Water Security, Protection and Resilience	UW-Milwaukee, Emerging area of need, Programs to be developed.	Threats to Supply, Catastrophic Events, Food Safety, Climate Resiliency, Maritime transportation of potentially harmful goods, Spills, Flooding and Droughts, Planning and Resiliency	Identifying Threats to Water Supply; Planning and "War-gaming" for Catastrophes; Infrastructure Planning for Climate Fluctuations; Increased Security Measures (including early alert systems) at Treatment Plants; Guaranteeing Supply Access to Municipal, Agricultural and Industrial Users , Real-time, integrated monitoring systems	Improved Drinking Water Safety, Readiness for Catastrophes to Water Resources, Reduced Water Risk to Industrial Users	Federal, State and Local Governments and Agencies, Engineering Consulting Firms, First Responders, Utilities	- Planning for an Oil Spill in the Great Lakes - Assessment of Security at Wisconsin's Drinking Water Plants
Healthy Recreational and Transportation Water Use	UW-La Crosse, UW-Milwaukee, UW Oshkosh, UW-Stevens Point, UW-Superior	Surface Water Quality, Public Health, Beach Safety, Legacy Contamination in Seafood, Ballast Water Contamination	Bacterial Source Tracking Technologies; Improved Storm- and Wastewater Infrastructure; Technologies to Reduce Risks of Ballast; Better Land-Use Management; Sensors and Early Alert Systems	Swimmable, Fishable, Drinkable Water; Improved Recreational and Tourism Opportunities; Reduced Risk Associated with Beaches, Reduced Risk from Consuming Seafood; Improved Public Health	Recreation and Tourism, Municipalities, Public Health, Shipping Industry	- Reducing Risk of Pathogens at Wisconsin's Beaches and Inland Lakes - Ballast Water Detection and Treatment Technologies for Wisconsin Harbors
Aquaculture/Aquaponics/Water Food Systems	UW-Madison, UW-Milwaukee, UW-Platteville, UW-River Falls, UW-Stevens Point	Aquaculture and Aquaculture Technologies, Animal and Plant Science, Economies of Scale, Food Safety, Food Processing Technologies, Workforce	Out-of-Cycle Spawning Techniques, Skilled Workforce, Water Reuse Technologies, Improved Filtration Technologies	Clean Source of Protein; Reduced Reliance on Imported Seafood; Reduced Reliance on Unsustainable Marine Fisheries; Healthier Seafood; Jobs	Aqua-Farming Startups, Farmers, Food and Beverage Industry	- Launching an "Intensive Aquaculture Industry" in Wisconsin

FUNDAMENTAL RESEARCH - TECHNOLOGY & INNOVATION - WORKFORCE DEVELOPMENT - POLICY & LAW - RESOURCE MANAGEMENT