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CLIMATE CHANGE AND THE

One Water Approach to Water Resources Management

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Water Resources and a Changing Climate

Changing precipitation patterns and increasing temperatures due to climate change are currently affecting water resources, and this challenge will continue into the future. The anticipated scenario for the Midwest, including Indiana, is an increase in the frequency and intensity of storm events, with increased precipitation in the cold season months, as well as periods of water stress due to increased evaporation and/or reduced precipitation during the warm season months (USGCRP, 2017; Cherkauer et al., 2021). The result is a possible reduction of available water when needed and an abundance of water when it is not needed.

Climate change can be viewed as a threat multiplier that further exacerbates complicated water resources management challenges brought about by human development patterns. Water management is affected by rising temperatures, changing precipitation patterns, and more intense rainfall. Waterways are interconnected systems, and development patterns alter the water cycle, stream form and function, aquatic ecology, and water quality. Higher temperatures, changing precipitation patterns, and increasing pollutants entering our waterways are negatively impacting our waterways (Höök et al., 2018).

Increased precipitation, combined with hard or impervious surfaces from development, parking lots, and roads means less water will infiltrate the ground and instead becomes runoff, which is far harder to control. The increase in stormwater runoff may amplify existing, or introduce new, pollution problems. Increased precipitation events may overwhelm stormwater management systems, leading to backups and resulting in flooding or even greater runoff of contaminants, such as nutrients, sediment, or bacteria, into local waterways.

Urban development magnifies the volume of runoff and increases the peak runoff rate in local streams. Due to climate change, precipitation is expected to increase in the winter and spring, which leads to more runoff. Many water treatment facilities are not able to handle the increase in volume nor store the water for future use.

This situation, along with periods of drought, will lead to a reduction in water supplies. If drought conditions are encountered, then stream flow is reduced possibly below base flow levels, which poses a threat to various ecosystems and drinking water supplies, and may exacerbate pollutants by concentrating them in various water bodies.

Another problem associated with stormwater flow involves compromised water treatment infrastructure nationwide. More frequent and intense precipitation events will lead to more combined sewer overflows (CSOs) in cities with combined stormwater and wastewater drainage systems. More CSO events will reduce water quality and make attaining water standards more difficult. These factors will complicate the water treatment process, reducing water quality and jeopardizing drinking water sources.

Incorporating a holistic approach to water resources management, coupled with climate change adaptation and mitigation strategies in local land use decisions, can better inform land use planning and development. The purpose of this document is to introduce a multi-tiered approach to planning to better address current and future issues associated with water resource management, development, and climate change.

One Water Approach

Based on the 2020 Census, 86 percent of the U.S. population live in a metro area (US Census Bureau, 2021). Population growth in the nation's cities is expected to continue into the future (Frey, 2020). Overall, U.S. cities have an aging infrastructure that will not support the projected population increases. Inadequate water resources and aging infrastructure means that development and economic growth will be restricted (Sedlak, 2019). Managing water resources is closely linked to the nation's cities' continued health and vitality.

The idea of "One Water" is not new but is increasingly implemented in water resources management due to climate impacts on freshwater resources. Instead of sending water and stormwater downstream or moving it immediately off the land, managers are retaining or holding the water until needed.

The water resources used daily are not restricted to what is collected from surface water or groundwater supplies. No matter where it comes from, water is an integral part of lifestyles and livelihoods. The water in streams, lakes, aquifers; the water used for drinking; the water used for food production to energy production or industrial needs; wastewater; and stormwater is part of the One Water strategy. All water has value for society.

In late 2020, it became possible to trade water on Wall Street through futures contracts. Unfortunately, the futures market does not address the root issue of water scarcity and leads to the practice of buying when the price is low, storing water at that time, and selling when the price is high. Other unforeseen problems due to a changing climate and the resulting impacts on water supply include:

- loss of ecosystem services,
- environmental damage,
- reduction of groundwater reserves, and
- increased costs of cleaning water for consumption.

Water allocation and usage is growing in strategic importance for cities and their elected officials, and water sustainability has become a critical unifying theme for many local communities. Looking at all water resources from a One Water management perspective can result in a range of positive outcomes for a community, ranging from vibrant neighborhoods to reduced flooding and sewage overflows.

THE U.S. WATER ALLIANCE OUTLINES THE HALLMARKS OF ONE WATER AS

- A mindset that all water has value
- A focus on achieving multiple benefits
- A systems approach
- Watershed-scale thinking and action
- Right-sized solutions
- Partnerships for progress
- Inclusion and engagement of all

(Shafer & Fox, 2016)

Example Strategies for Implementing the One Water Approach

Under the One Water planning strategy, multiple stakeholders, such as utilities, plan commissions, and regional and statewide organizations, collaboratively prepare for and balance multiple water needs within a community and the watershed. In this approach, communities recognize that actions upstream will impact their neighbors downstream.

To implement One Water planning, communities can turn to readily available resources, tools, and examples from peer communities to guide their efforts. For example, the Blueprint for a One Water Approach, sponsored by the Water Research Foundation and developed by Brown and Caldwell in 2017, outlines an integrated, collaborative planning approach to water resources management. The detailed guidance provides the phases of planning for the One Water approach. The planning phases emphasize stakeholder engagement and multiple feedback opportunities structured throughout an iterative

process. Setting the foundation focuses on defining the scope, identifying partners, and assessing needs and opportunities. The establishing direction phase includes creating a common vision and objectives among diverse partners. Developing a framework involves creating a plan or program for long-lasting leadership and institutional structure. Additionally, it includes adaptive planning and financing strategies. Implementing the framework focuses on monitoring shared metrics, reporting, and collaborative updates. Furthermore, pilot or demonstration projects can effectively demonstrate framework strategies.

The U.S. Water Alliance's One Water Roadmap further identifies six arenas of action, which include a compilation of interconnected strategies that communities can use to implement a One Water approach. The arenas and selected strategies include (Shafer and Fox, 2016):

Arena: *Reliable and resilient water utilities*

Example strategy: utilizing green infrastructure for stormwater management and greenspace enhancement

Arena: *Thriving cities*

Example strategy: Integrated planning across the water cycle

Arena: *Competitive business and industry*

Example strategy: Developing upstream and downstream partnerships in watersheds

Arena: *Sustainable agriculture systems*

Example strategy: Implementing watershed scale planning and monitoring

Arena: *Social and economic inclusion*

Example strategy: Enhancing community capacity to engage in water planning and governance

Arena: *Healthy waterways*

Example strategy: Utilizing community science for ecosystem monitoring and education

Managing water from within one community or watershed still presents challenges. Although a community may be water-efficient, there are water-related challenges just beyond community boundaries. Businesses, utilities, and local governments need to work collectively with surrounding communities to improve water management. Collaboration on shared water goals across all consumers and the supply chain is the key strategy for realizing sustainable One Water management.

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