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INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

FLOODPLAIN WASTE WATER RE-USE AND INDIRECT DISCHARGE

Background

Communities across the nation are implementing innovative approaches to re-use and gain benefits from discharged treated wastewater. Typically, wastewater undergoes primary and secondary treatment; facilities may also utilize tertiary treatment to reduce specific pollutants, like nutrients. These treatment methods ensure that effluent meets or exceeds water quality standards prior to discharge directly into rivers, streams, or other receiving waters.

Alternatively, indirect discharge of water is way to transport effluent over land via open channels, often through floodplains to streams, rivers, or other water bodies. Permit standards for effluent quality have traditionally been designed for discharge directly into flowing waters. Direct discharge methods utilize a mixing zone where some pollutants are diluted to permissible concentrations. However, some facilities request and receive permits to indirectly discharge their effluent over land to provide environmental benefit from water re-use.

To ensure safe water resources and protect our nation's water from excess pollution, research is ongoing to evaluate and identify potential risks and benefits of water re-use and indirect discharge. Discharging over land allows effluent to interact with sediment, plants, and the environment where the water can support habitat or ecosystems that need water. Given the complexity of water movement and chemical changes unique to over-land discharge in floodplains, it is important to understand how effluent will move, change, and affect groundwater and nearby water bodies.

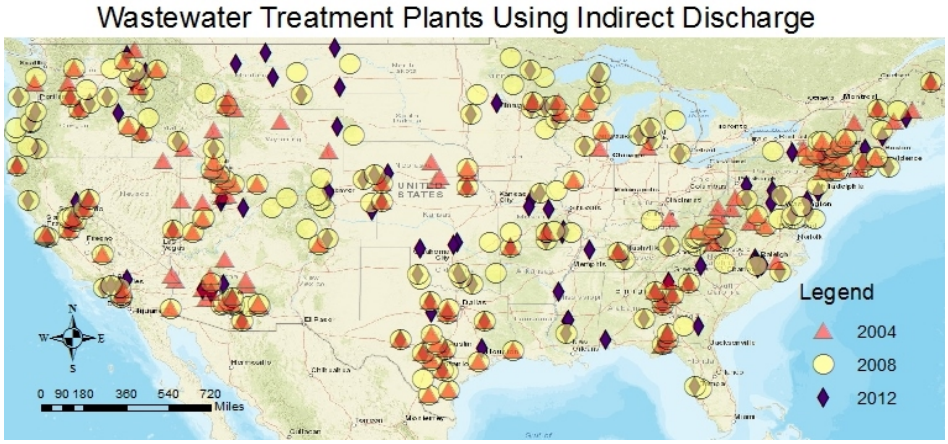

Figure 1: The distribution of wastewater treatment plants that discharge indirectly into floodplains across the U.S. based on proximity to rivers and streams using data from three of the EPA's most recent voluntary Clean Watersheds Needs Surveys.

Indirect Discharge

Potential benefits of indirect discharge include increased availability of water for habitat or irrigation, improved water quality through plant uptake or microbial reduction of pollutants, and even recharge of depleting aquifers. Because indirect discharge can naturally reduce pollutants, indirect discharge is sometimes compared to expensive tertiary treatment methods. Still, concerns over nutrient and metal accumulation, as well as other unforeseen contamination of soil and groundwater make this an important area of research to support existing and future discharge decisions.

To understand how common indirect discharge is and to evaluate the risk to our nation's water, we must know where and how frequently the method is utilized. Currently, no public dataset provides information on all wastewater treatment plants, their treatment level, and discharge method. However, the EPA's Clean Watersheds Needs Survey (CWNS) provides valuable information on a subset of publically owned treatment works that are seeking funds from the federal government.

Across the United States

Using data from the CWNS between 2004 and 2012, we compared the frequency and distribution of indirect dischargers relative to direct dischargers across the nation. We show which of these facilities are utilizing indirect discharge near rivers and streams (within 100m; Figure 1). The sites are nationally dispersed with higher frequencies surrounding metropolitan areas.

Approximately 3% of treatment plants included in the CWNS utilized indirect discharge (Figure 2). This proportion remained relatively constant accross the survey years. Of those using indirect discharge, almost none were noted as treating for nutrient removal.

By providing information on both nutrient treatment and discharge methods at the facilities, the CWNS provides a snapshot of how indirect discharge is utilized throughout the U.S. Still, the voluntary nature of the survey may include potential regional or frequency biases in what was reported. Nonetheless, in 2012, 51% of all treatment plants were represented in the CWNS when compared to the EPA's Facility Registry Service (FRS) which compiles all facilities subject to environmental regulation.

Current Research Efforts

EPA scientists from the Office of Research and Development are studying the use of inland floodplains as natural green infrastructure (GI) for wastewater management, including an evaluation of how natural GI, like indirect discharge practices, influence water quality.

Some of this work is being conducted on the Yakima River floodplain in Washington state, where researchers are working with the City of Yakima to evaluate how groundwater and surface water quality responds to indirect discharge on a newly restored floodplain.

To examine the effects of indirectly discharging treated effluent for beneficial irrigation in a farmed floodplain, scientists are working with agricultural researchers in Chickasha, Oklahoma. Soil, surface water, and groundwater will be examined to evaluate the potential risks for contamination of receiving waters when effluent is used to grow crops.

Some of the data gaps highlighted by the CWNS are being addressed by the EPA Office of Water's National Study of Nutrient Removal and Secondary Technologies. A survey to gather basic information on discharge procedures and nutrient removal from all treatment works in the U.S. with a National Pollutant Discharge Elimination System (NPDES) permit is in development. The new survey will create a valuable dataset, enabling a more comprehensive assessment of wastewater treatment and effluent quality in the U.S.

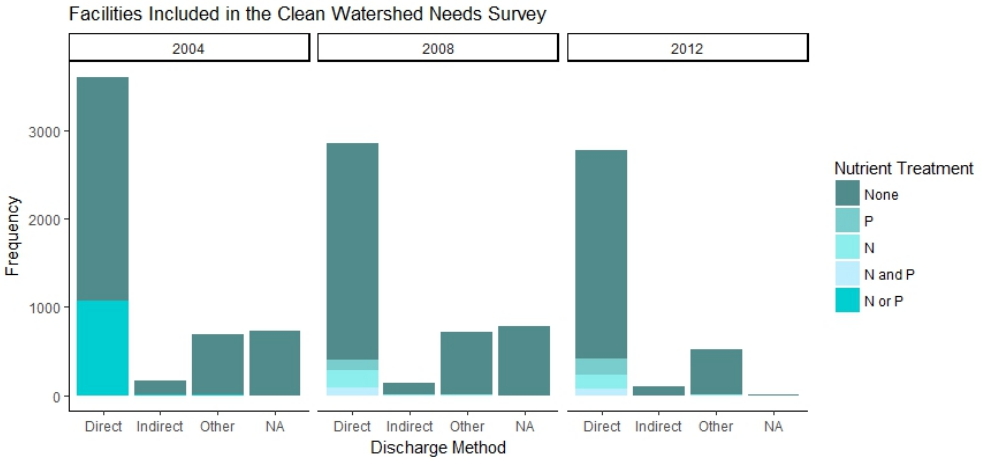

Figure 2: The number of wastewater treatment plants discharging directly into streams or rivers, indirectly into floodplains, using other methods or not reporting their discharge method, according to data from the EPA's most recent Clean Watersheds Needs Surveys. Few of the facilities using indirect discharge methods treated effluent to remove nitrogen (N) or phosphorus (P).

The CWNS survey is a useful tool to understand how effluent is managed across the country. The survey collects information on discharge method, but it does not distinguish between different reuse applications and disposal methods or include treatment plants that rely solely on land application that are not point sources or require a NPDES permit. However, by using the existing survey results we can better understand patterns and anticipate research needs.

These efforts are important starts to evaluate risks to different natural resources and water, but continued effort is needed to create a comprehensive evaluation of indirect dischargers across the nation.

Future Objectives

While we know that indirect discharge to floodplain river systems can provide many important benefits, few studies have shown how these practices stand up to risks over time and space. Pollutants from effluent such as nutrients, heavy metals, pharmaceuticals, and organic wastewater compounds can accumulate in water and soil, affecting human and ecosystem health. Because many environmental factors influence pollutants, their effects will be evaluated to assess long-term ecosystem and health risks.

Data collected from this and future research efforts will continue to provide a stronger foundation for assessing the benefits and risks associated with the use of wastewater effluent in floodplains and other inland systems. These research efforts are critical to help support our obligation to sustain, protect, and preserve clean water across the Nation.

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REFERENCES:
EPA: Clean Watershed Needs Survey (2004, 2008, 2012) https://www.epa.gov/cwns

EPA: Nutrient Innovations Task Group. Report of the State, An Urgent Call to Action (Aug 2009). https://www.epa.gov/sites/production/files/documents/nitgreport.pdf

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