Civil, Environmental and Architectural Engineering

UNIVERSITY OF COLORADO **BOULDER**

MS Thesis Defense

Brendan Purcell

Assessing Downstream Impacts from an Additional Consumption of Reclaimed Wastewater Effluent

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Faculty Advisor: Professor Joseph Kasprzyk

Abstract:

Consuming reclaimed wastewater effluent is becoming an increasingly popular alternative to consuming surface water or groundwater supplies. Although locally sustainable, impacts to downstream stakeholders require consideration prior to implementation of a proposed consumption. These downstream impacts are not typically evaluated in a quantitative manner, accounting for geospatial and systematic differences. Under certain statutory environments, downstream stakeholders may have a path towards legal recourse if additional consumption is determined to impact them. More broadly, the extent of downstream impacts is important in legal and policy contexts regarding the sustainability of reclaimed water projects. In this thesis, a framework is presented to assess downstream impacts resulting from an additional consumption of reclaimed wastewater. This framework includes a scenario analysis of the region where the proposed consumption is conducted. This analysis is coupled with a pooled t-test on a transformation of streamflow data to determine the statistical significance in changes to mean streamflow. Further, potential lower streamflow is linked to impacts on downstream stakeholders through the use of stakeholder performance metrics. This framework is assessed in two distinct case studies in contrasting regions of the United States: 1) the Illinois River downstream from the greater Chicago, Illinois area, with a general abundance of water and large potential reclaimed water users, and 2) the Middle Rio Grande River downstream from Albuquerque, New Mexico, with high seasonal variability in water availability, ephemeral streamflow patterns, and prior appropriation water rights. In Illinois, impacts to barge transportation are assessed and determined to decrease with distance downstream of the proposed effluent consumption. In the Rio Grande, impacts to the Rio Grande silvery minnow are considered and determined to worsen with distance downstream of consumption, such that a proposed consumption would be unlikely to be established under federal regulations.

Brendan got his B.S. in Civil engineering from Syracuse University in 2017. Following this, he joined the Hydrology, Water Resources, and Environmental Fluid Mechanics program in Civil Engineering at the University of Colorado Boulder. Under the guidance of Dr. Joseph Kasprzyk from CU Boulder and Dr. Ashlynn Stillwell from the University of Illinois, his research has focused on quantifying impacts resulting from reclaimed water consumption. Outside of school, Brendan enjoys hiking, mountain biking and brewing his own beer.