Reclaimed Water Infiltration Study

Task 3: Risk Assessment

LOTT Clean Water Alliance

Study Framework

The key question that the overall study is intended to answer is:

What are the risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day, and what can be done to reduce those risks?

The overall study has four main tasks designed to answer specific questions.

Task 1: Water Quality Characterization
What is the current quality of our local waters: groundwater, surface water, drinking water, wastewater, and reclaimed water?

Task 2: Treatment Effectiveness Evaluation
What happens to reclaimed water that is infiltrated to groundwater: where does it travel and how quickly, and how does the quality of the water change over time?

Task 3: Risk Assessment
What are the relative risks of replenishing groundwater with reclaimed water?

Task 4: Cost/Benefit Analysis
What are the costs and benefits of various approaches for treating and using reclaimed water?

Overview of Task 3

This fact sheet provides highlights of the third task of the Reclaimed Water Infiltration Study: Risk Assessment. For more details about the study, visit lottcleanwater.org.

Task 3 assessed potential risks to human health and the environment, using these questions for a step-wise analysis.

- Of the residual chemicals found in reclaimed water, which might be of concern to human or ecological health?
- Are any of the chemicals at a level of concern in reclaimed water?
- After reclaimed water is used to replenish groundwater, are any of the chemicals estimated to occur at a level of concern in groundwater or surface water?
- How might people or animals be exposed to the chemical in water, and would their level of exposure cause potential risk?

Key Findings

- Risks to human health from using reclaimed water to replenish groundwater are quite low. Out of 134 chemicals analyzed, 132 were found to be below levels of concern. Two were slightly above the minimum level of concern, though the risk level for both was very low.
- No risks to ecological health were identified. None of the residual chemicals were predicted to pose a risk to wildlife in watersheds influenced by reclaimed water.
- The Peer Review Panel, a group of national experts who have reviewed each step of the study, indicated the assessments were well designed and protective of human and ecological health.

Number of Residual Chemicals Identified in Task 3 Analysis

Human Health Risk Assessment

The human health risk assessment followed a step-wise process according to accepted protocols. The assessment began with a broad list of residual chemicals and gradually narrowed the focus to chemicals with potential human health effects.

Health Effect Thresholds

The first step was determining if a chemical posed potential health effects and at what level, or concentration. Assessors used best available science to set a health effect threshold for each chemical detected in reclaimed water sampling. Thresholds were based on state and U.S. EPA water quality standards if available, or were derived from published toxicity criteria, toxicity data, or therapeutic doses.

Screening Evaluation

For each of the residual chemicals detected in reclaimed water, the maximum concentration detected was compared to the health effect threshold for that chemical. If the chemical concentration was equal to or greater than 10% of its threshold, it was included in the next step for further evaluation as a chemical of interest. To err on the side of caution, all the hormones and PFAS chemicals were included in the next step as entire categories of interest, even though most did not exceed 10% of their threshold.

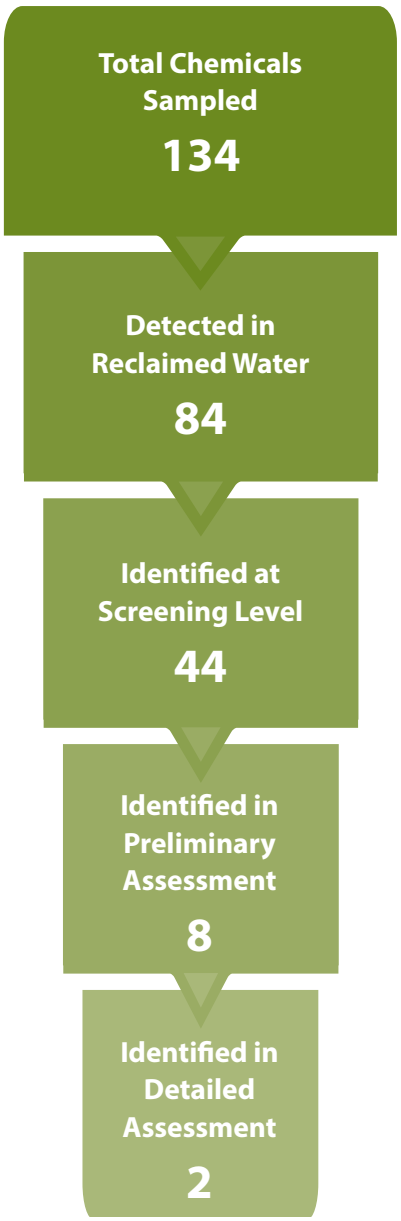
Preliminary Assessment

For each chemical of interest, groundwater modeling and field data were used to predict the exposure point concentration – the amount of the chemical to which people or animals might be exposed. The predicted concentration for each chemical was then compared to its health effect threshold. If the concentration was equal to or greater than 10% of the threshold, the chemical was included in the next step of evaluation.

Detailed Assessment

In this step, assessors considered how much of a residual chemical a person or animal in various scenarios might take in through drinking, breathing, and skin contact. The assessors considered children and adult residents living in the area, landscape workers, children playing at a park or water feature, children and adults recreating at local creeks, and people who might consume fish from local creeks. For the resident scenarios, two levels of exposure were considered per U.S. EPA methods – a maximum exposure level and a more likely average-level exposure. Chemical exposures did not exceed levels of concern in any of the scenarios considered, except for the maximum exposure level for residents. Under that scenario, two chemicals were identified as a potential concern.

Residual Chemicals of Potential Concern



Findings

Of the 134 chemicals analyzed, 132 were found to be below levels of concern for human health. Two chemicals were identified as a potential concern in one scenario, though the risk level for both chemicals was quite low. There were multiple layers of protective assumptions built into the risk assessment, meaning the assessors erred on the side of caution when making decisions about the health effect thresholds used, to what degree chemicals break down or disperse in the soil or aquifer, and how people might be exposed (like how much water they may drink from one source over a lifetime). For these reasons, the findings are more likely to overestimate risk than to underestimate it.

Perfluoropentanoic acid (PFPeA) is one of the chemicals that slightly exceeded the level of concern for one scenario. Under a maximum exposure resident scenario, a child drinks one liter of water daily, 350 days a year, for at least 6 years, from the same household water source. This results in a noncancer risk of 1.3, slightly above the threshold of 1.0. At this risk level, adverse health effects are considered unlikely. This chemical did not rise to a level of concern for the more likely exposure resident scenario or for any of the other scenarios considered.

PFPeA is a by-product from the breakdown of other per- and polyfluoroalkyl compounds, commonly referred to as PFAS chemicals. Sources include stain and water resistance carpets, clothes, furniture, food packaging, personal care products, and fire-fighting foams.

N-Nitrosodimethylamine (NDMA) also slightly exceeded the level of concern for one scenario. Under a maximum exposure resident scenario, an individual drinks approximately one liter of water a day as a child and 2.6 liters of water per day as an adult, 350 days per year for a period of 32 years, from the same household water source, and also bathes daily and breathes the air in the home during that time frame. This results in an estimated lifetime excess cancer risk of 2.9 in 1,000,000. This is slightly above the threshold for negligible risk of 1 in 1,000,000, and is within the range of risks considered acceptable by U.S. EPA. NDMA was not consistently found in samples of reclaimed water or groundwater. However, to err on the side of caution, assessors assumed it was present consistently at a concentration near the average of detections.

Sources of NDMA include cured meats, beer, fish, cheese, tobacco, shampoo, cleansers, detergents, pharmaceuticals, cosmetics, solvents, and as a by-product of some water disinfection processes.

Assessors considered children and adult residents living, working, and playing in the area.

Ecological Risk Assessment

This assessment considered potential impacts from residual chemicals based on their concentration in water and their potential to accumulate over time in living animals (bioaccumulate). Fish, birds, and fish-eating mammals in McAllister and Woodland Creeks, two water bodies where groundwater containing reclaimed water might mix with surface water, were considered in this step-wise assessment.

Screening Evaluation

Concentrations of chemicals detected in reclaimed water were compared to ecological health screening thresholds for water. If concentrations were greater than the threshold or if the chemical was potentially persistent or bioaccumulative, the chemical was included in the next step for further evaluation.

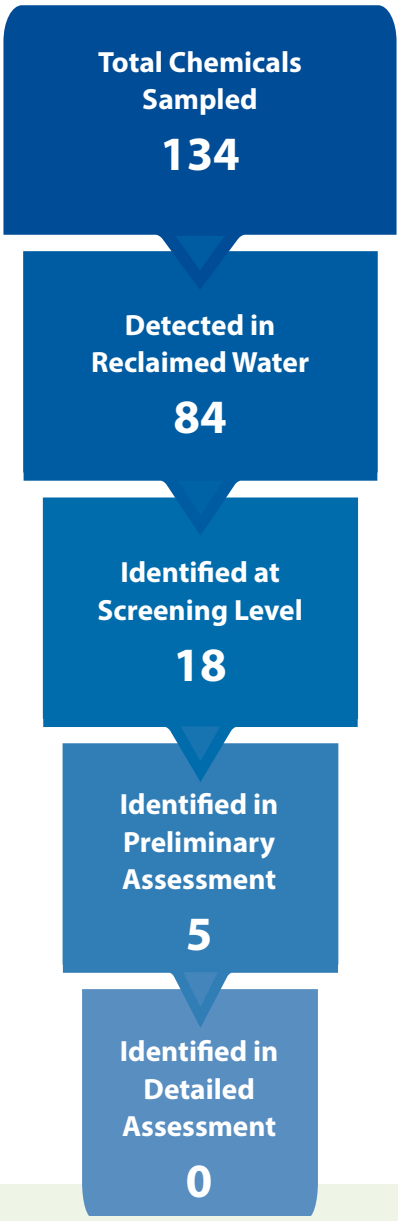
Preliminary Assessment

Groundwater modeling and field data were used to predict exposure point concentrations in Woodland and McAllister Creeks for each chemical of interest. Concentrations were then compared to the screening thresholds. If the concentration was equal to or greater than the threshold or considered persistent or bioaccumulative, the chemical was included in further evaluation.

Detailed Risk Assessment

Toxicity thresholds (below which adverse effects are not expected to occur) were set for each chemical based on existing standards and toxicity data for surface water, fish tissue, and wildlife dietary doses. These values were used along with the exposure point concentrations to calculate the potential for adverse effects. None of the residual chemicals were predicted to harm wildlife in either ecosystem studied. Residual chemicals in these systems were far below any levels of concern.

Residual Chemicals of Potential Concern



Summary

Findings from Task 3, Risk Assessment, show that risks to human health from using reclaimed water to replenish groundwater are quite low, and no risks to ecological health were identified. The Peer Review Panel stated that both the human health and ecological risk assessments are well designed, follow accepted practices, and are conservative, meaning they are more likely to overestimate than underestimate potential risk.

What's Next?

Task 4 will examine how risks identified in Task 3 might be addressed, including the costs and benefits of various options for treating and using reclaimed water.

The study is anticipated to be completed in 2022. Community conversations about study results will help inform decisions about future reclaimed water treatment and use.

Get Involved!

- Learn more or sign up to receive email updates about the study:
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