MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 25-578 (project 690) | April 2025

Pilot Scale Evaluation of Escherichia Coli Removal from Stormwater Runoff Using Steel Byproduct Filtration

the ISSUE

Escherichia coli (E. coli) in stormwater runoff can cause serious contamination in natural waters. Filtration using steel chips and steel slag media have shown the capacity to remove E. coli from stormwater. Pilot scale studies are needed to verify the performance of steel byproduct filters and promote their full-scale applications.

the RESEARCH

The objective of this study was to design and construct a pilot scale steel byproduct filtration structure at a stormwater site in Sioux Falls, SD, and evaluate the filter's performance for E. coli and phosphate removal under real stormwater treatment conditions. The stormwater best management practice site at 3103 S. Sycamore Avenue was selected for the study. This site has a stormwater retention pond and a downstream discharge channel. The City of Sioux Falls constructed a concrete filter structure at the discharge channel, which included two filtration sections with each section containing a 20-ft long, 6-ft wide, and 1.5-ft high filter media. The filter media consisted of 70% steel slag and 30% steel chips. After constructing the filter structure, the SDSU project team conducted five sampling events under different stormwater flow conditions from June to August 2024. Each event had 12 sampling points for both filter influent and effluent. All collected samples were analyzed for E. coli and phosphate to determine the filtration removal efficiencies. Iron concentrations were also analyzed for each sample to evaluate the level of iron leaching from steel byproduct media.

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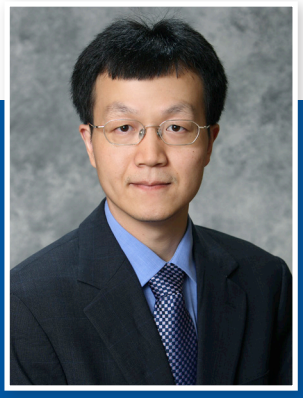

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Project Title

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East Dakota Water Development District, Brookings, SD

South Dakota State University, Brookings, SD

City of Sioux Falls, SD

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the **FINDINGS**

The average stormwater flow rate during the five sampling events for the pilot stormwater filtration study was 0.67 cubic feet per second (cfs), which is well above the design flow of 0.26 cfs. The filter average influent E. coli concentration was 1120 MPN/100 mL, and the filter average effluent E. coli concentration was 625 MPN/100 mL. The pilot filter removed an average of 44.2% of the E. coli in the stormwater. The filter also effectively removed phosphate. The average filter influent phosphate concentration was 0.13 mg/L and the average filter effluent phosphate concentration was 0.06 mg/L. The pilot filter removed an average of 53.8% of the phosphate in the stormwater. An average increase of 0.03 mg/L of iron concentration was observed after filtration. All the filter influent and effluent iron concentrations were well below the Environmental Protection Agency's secondary drinking water standard of 0.3 mg/L.

the **IMPACT**

E. coli in stormwater runoff presents a significant environmental risk for both human and aquatic health. Conventional stormwater treatment technologies are generally not effective at removing E. coli. The pilot scale study's results showed that media filtration using steel chips and steel slag effectively removed E. coli and phosphate under real stormwater treatment conditions. Full-scale applications of this filtration technology are recommended to reduce the E. coli and phosphate contamination from stormwater runoff and protect natural water resources.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1251

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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