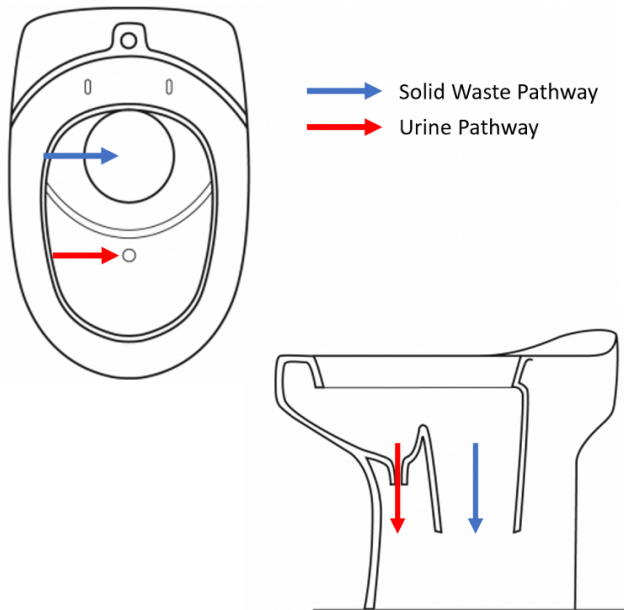


How it Works

While there are no current plans to implement this design, we want you to know exactly how it works in case there ever is.



—→ Solid Waste Pathway
—→ Urine Pathway

ANY QUESTIONS?

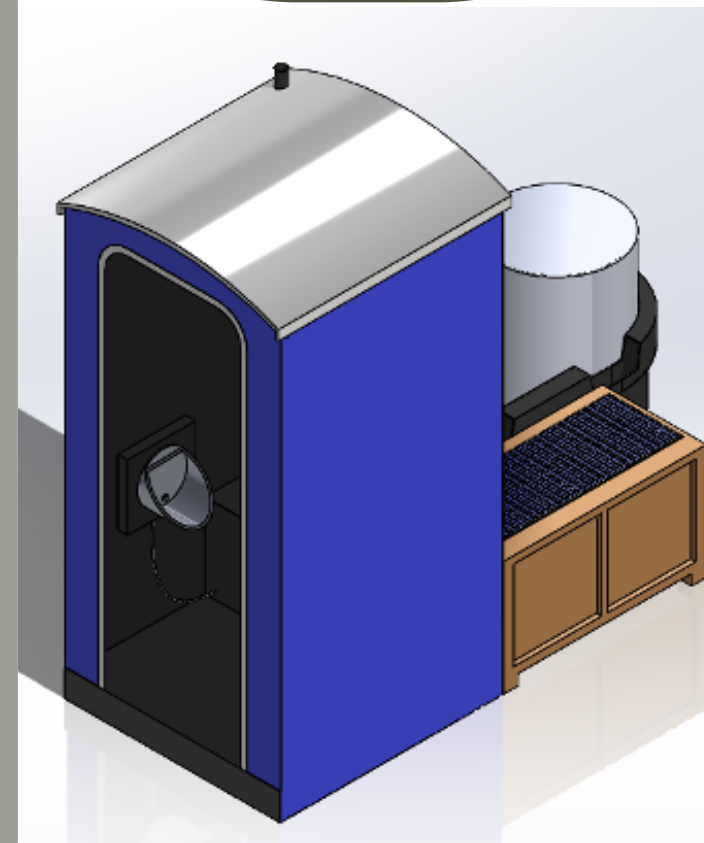
If you have any concerns, or want more detail on our design, please feel free to ask! We want as much community input as possible for this project to ever come to fruition.

GOLDENSUSTAINABILITY@CITYOFGOLDEN.NET

ABOUT THE DESIGN TEAM

We are a team of four Seniors at Colorado School of Mines
Maddie Finley - Civil Engineering
Chloe Lopez-Jauffret - Environmental Engineering
Emily Phaneuf - Environmental Engineering
Amelia Snyder - Mechanical Engineering

THE GOLDEN TOILET



Urine-Diverting toilet for Golden's Community Garden fertilization needs

The proposed design would be a common portable toilet retrofitted with a urine diverting seat insert, as shown above

The diverted urine will flow from the seat into a pump housing structure behind the portable toilet, which will then flow into a pasteurizer, where the urine will be heat treated using solar energy to remove all pathogens (90°C for 5 min.)

IS IT SAFE?

The proposed system uses pasteurization, the EPA-approved method for pathogen removal in wastewater. Studies have shown that fecal coliform concentrations in urine see a 3-log removal rate within the first day of storage at only 60°C [2]. Other studies involving pasteurization of biosolids showed that no organisms (*Ascaris*, *Toxocara*, *Trichuris*, *Taenia*) survived after 5 minutes at 90°C [3]. Assuming the diverted urine contains 3-5 mg Nitrogen per liter, you would need about 1 liter of urine for your 10 ft x 10 ft plot every 3 weeks. Make sure to dilute the urine with at least 3 parts water for every part urine to maximize plant absorption.



WHY URINE DIVERSION?

Urine naturally contains high concentrations of Nitrogen compounds, which is very beneficial to plants! Separating urine from solid waste at the source allows us to safely reuse urine as fertilizer, avoiding the resources and cost that comes along with other organic and non-organic fertilizers.

Peristaltic pumps were chosen to pump the diverted urine to the pasteurizer due to their ability to accommodate larger tubing diameters, specialized corrosion-resistant tubing, and ease of maintenance. The team's design will utilize a 100-watt solar panel to power the pumps, as well as the pasteurizer.

Our system also includes backup storage tanks as well as a secondary containment basin in case there is ever an overflow, no urine will flow into the garden space, natural waterways, or the Golden Water Treatment Plant.

[1] "EcoDry Drawings," Toilet Revolution, [Online]. Available: https://www.toiletrevolution.com/wp-content/uploads/ecodry_drawings.png.

[2] X. Zhou, Y. Li and Z. Li, "Investigation on microbial inactivation and urea decomposition in human urine during thermal storage," *Journal of Water, Sanitation, and Hygiene for Development*, vol. 7, no. 3, pp. 378-386, 2017.

[3] H. Goetsch, R. Mullen, R. Lahr and A. Noe-Hays, "Fate of pharmaceutical and biological contaminants through the preparation and application of urine derived fertilizers," *Proceedings of the Water Environment Federation*, vol. 10, pp. 1994-2006, 2015.

