2026 Campus Race to Zero Waste Case Study

Villanova University

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Focus of Case study:
Liquid-waste capture bins in an academic building diverted beverage liquids from trash and recycling, reducing disposal weight and identifying campus-wide waste and emissions-reduction opportunities.

Detailed description of campaign or effort:
Waste audits at Villanova University consistently revealed hundreds of partially full beverage containers entering trash and recycling streams despite the presence of recycling infrastructure. Because convenient sinks were often unavailable, students disposed of liquids directly into waste containers. The resulting excess weight increased hauling requirements while reducing recycling quality. To better understand the scale of this issue, Villanova launched a liquid-waste bin system pilot and conducted the following study to measure efficacy.

During the 2025-2026 academic year, Villanova University conducted a waste-weight study to evaluate whether the liquid-waste capture system reduced the weight of materials sent through trash and recycling pathways. The study focused on the first floor of the Drosdick Hall (Engineering Building), which includes a Holy Grounds cafe and multiple liquid-waste bin stations.

The project team partnered with custodial staff to establish a collection and tracking process. The waste weight data was collected from Monday morning through Friday morning for the solid and beverage waste. Each liquid-waste system was assigned a color-coded location identifier as shown in Figure 5. When custodial staff emptied trash and recycling bins, bags were secured with matching color-coded zip ties and staged in designated tubs (see Figures). Student or project volunteers weighed and recorded each bag the following morning (Tuesday - Friday). At the end of each week, on Friday morning, the liquid-waste bins were weighed and sampled.

The study found that liquid waste represented 19% of the total measured waste weight on the first floor of the Engineering Building, while trash represented 56% and recycling represented 25% (see Figure). The results indicate that liquid capture bins can effectively divert beverage waste from trash and recycling streams. Utilization also varied by bin location: the station nearest to the cafe had the highest average daily collected weight, while the station with the lowest use was farther from primary food-service activity.

Planning steps & timeline to implement

- [Fall 2024 / September]: Define the research question, project scope, and success measures.
- [Summer 2025 / July-August]: Train student/project volunteers to weigh bags, record data, and handle liquid-bin measurements including carrying out a test run.
- [Fall 2025 / October]: Select the first floor of the Engineering Building as the study area because of its cafeteria and multiple bin stations.
- [Fall 2025 / November]: Map bin locations and assign each station a color-coded identifier.
- [Fall 2025 / November]: Coordinate with custodial staff on collection procedures, color-coded zip ties, bag staging, and safety expectations.
- [Fall 2025 / November 18-21, December 9-12]: Collect daily trash and recycling bag weights by location; collect weekly liquid-bin weights and samples.
- [Spring 2026 / January – April 2026]: Analyze waste-stream composition, location-based utilization, annual building projections, and campus-wide diversion scenarios.
- [Spring 2026 / April - May 2026]: Share findings with university management and identify recommendations for future implementations.

Resources and stakeholders involved

The project relied on collaboration among the University Facility Management Office's Waste & Recycling Manager, Custodial staff, Sustainable Engineering faculty advisers, students, and project volunteers.

Project team and contributors:

Sustainable Engineering Students:

- Abigail Hammar
- Isaac Bua
- Kamil Aliyev
- Ebenezer Owusu
- Queen Okon
- Mohamed Abouzeid

Villanova University Student Volunteers

- Aidan Dorian
- Liseth Mejia Perez
- Emma Spangler

Faculty Advisor:

- Dr. Mary McRae

- Dr. Ross Lee
- Al Motel

Custodial Team

- Derrick Brown
- Valerie Barnes
- Stephen Most

Custodial staff were essential partners in implementing the color-coded collection process and staging bags for measurement. Sustainable Engineering students and/or project volunteers supported daily weighing, data recording, and weekly liquid-bin measurements.

Resources included existing liquid-waste capture bins, color-coded zip ties, collection tubs, scales, data-recording tools, personal protective equipment, and access to laboratory or analytical resources for liquid characterization.
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Results of This Campaign Component

The study provided Villanova University with a practical, campus-specific evaluation of liquid-waste capture bins and demonstrated the value of collaboration among the University Facilities Management Office's Waste & Recycling Manager, custodial staff, Sustainable Engineering faculty advisers, students, and project volunteers. This collaborative approach established a repeatable model for future campus waste-reduction initiatives. The project findings were presented to the Villanova University Sustainability Leadership Council to support future planning and decision-making related to campus waste management.

During the study period, approximately 91.6 pounds of beverage liquids were diverted from the trash and recycling streams. Liquid waste accounted for 19% of the total measured waste weight on the first floor of Drosdick Hall, while trash accounted for 56% and recycling accounted for 25%. The liquid-waste station located nearest the Holy Grounds Café had the highest average daily utilization, demonstrating the importance of strategically locating liquid-waste capture systems near food-service areas.

Using the Engineering Building study results together with the University's 2025 campus waste-hauling data, the project estimated that implementing liquid-waste capture systems across campus could eliminate approximately 209 waste-hauling truck trips over the course of a calendar year. This estimate assumes that the proportion of liquid waste measured in the Engineering Building is representative of campus-wide waste generation and that a 20% liquid-diversion rate is achieved.

Although beverage liquids are often overlooked in waste management planning, this study demonstrates that they represent a measurable waste stream whose diversion can improve recycling quality while reducing overall disposal weight. These findings provide a strong foundation for expanding liquid-waste capture systems across campus and integrating them into future zero-waste initiatives.

What would you do differently in the future?

In the future, communications with the custodial team and any other stakeholders would start earlier on in the conception of the project. Future studies would expand the monitoring period across multiple semesters and include additional building types to better capture seasonal changes and different user behaviors. The liquid waste team would also evaluate bin placement before installation, prioritizing locations near cafes, vending areas, and other beverage-consumption hotspots.

The next phase should also establish a consistent campus-wide measurement protocol and evaluate operational considerations such as collection frequency, maintenance needs etc. Pilot programs in residence halls, offices, and athletics facilities would help determine where liquid-waste capture provides the greatest operational and environmental benefit.

What advice would you give to another college that wanted to do a similar effort?

Start with a focused pilot in a high-traffic location with food or beverage service and limited access to sink drains. Place liquid-waste bins directly beside trash and recycling bins so users can empty containers before disposal. Involve custodial staff from the beginning; their operational knowledge is essential for designing a collection process that is safe, realistic, and sustainable.

Use a simple location-coding system to understand which stations are most effective. Measure both waste weights and user-location patterns, since bin placement can strongly influence participation. Finally, begin with readily understandable outcomes, such as pounds diverted, percentage of waste captured, and reduced recycling contamination, before expanding into more complex emissions or financial analyses.

Photos and graphics

Figure 1. Liquid-waste capture bins placed beside trash and recycling bins at Villanova University.

Caption: This system gives users a convenient way to empty beverage containers before disposing of the container in the appropriate waste stream.

Photo credit: Villanova University Liquid Waste Project Team

Figure 2. Liquid-waste collection container.

Caption: The internal collection container captures leftover beverage liquids for separate collection and measurement.

Photo credit: Villanova University Liquid Waste Project Team

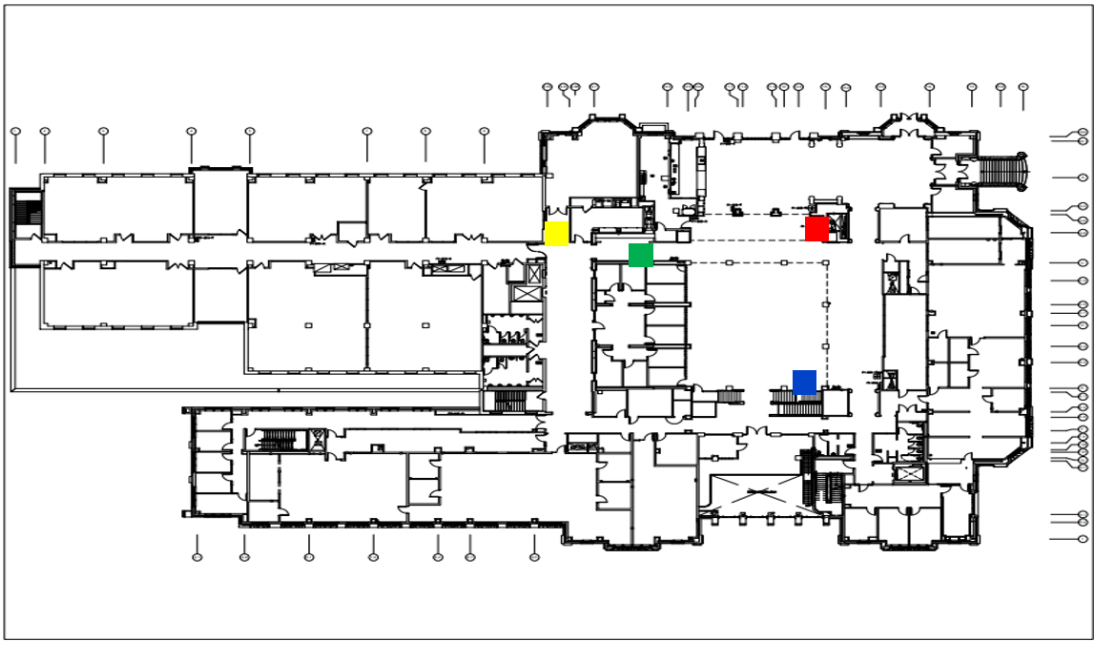

Figure 3. Color-coded map of liquid-waste, trash, and recycling stations on the first floor of the Drosdick Hall.

Caption: Color-coded locations supported custodial collection and enabled location-specific waste-weight analysis.

Graphic credit: Villanova University Liquid Waste Project Team

Figure 4. Sample Color-coded zip ties stored inside the corresponding liquid-waste bin.

Caption: Custodial staff used color-coded zip ties assigned to each bin location to identify collected trash and recycling bags during the waste-weight study.

Photo credit: Villanova University Liquid Waste Project Team

Figure 5. Color-coded waste bags staged in designated collection tubs.

Caption: After collection, custodial staff placed emptied trash and recycling bags with matching color-coded zip ties in designated tubs for next-day weighing and data recording.

Photo credit: Villanova University Liquid Waste Project Team

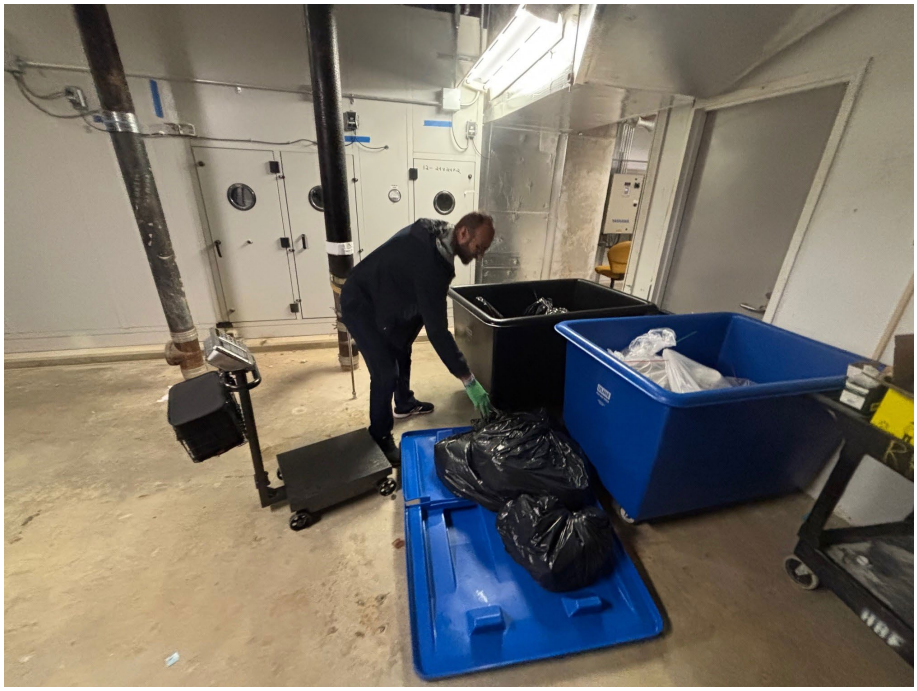

Figure 6. Student or project volunteers weighing and recording collected bags.

Caption: Student team members and volunteers weighed each tagged bag the following morning and recorded their weights by waste stream and bin location.

Photo credit: Villanova University Liquid Waste Project Team

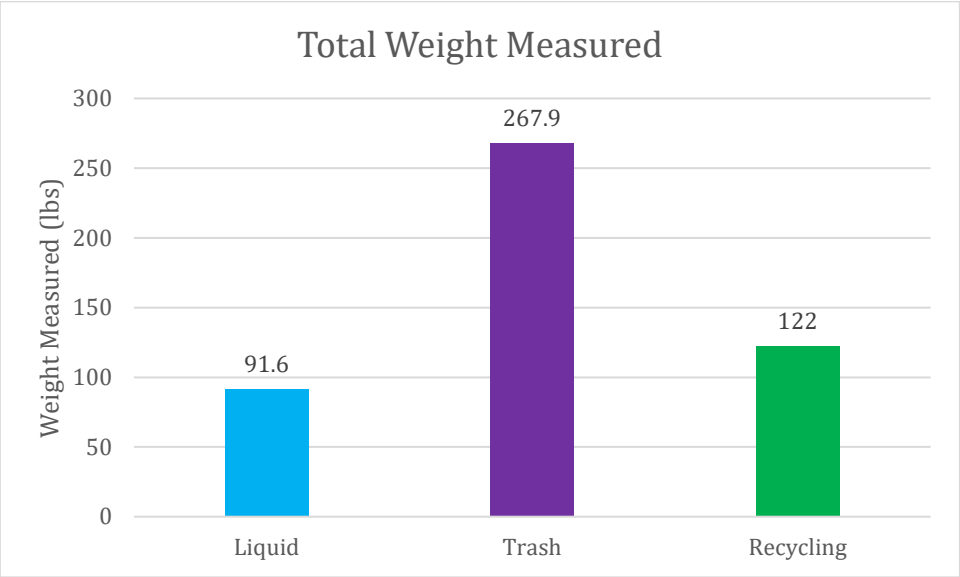

Figure 7. Total weight measured over the two week data collection period

Caption: Total weight measured for trash, recycling, and liquids. The largest weight measured was from trash at 267.9lbs and the lowest was from liquids at 91.6lbs.

Graphic Credit: Villanova University Liquid Waste Project Team

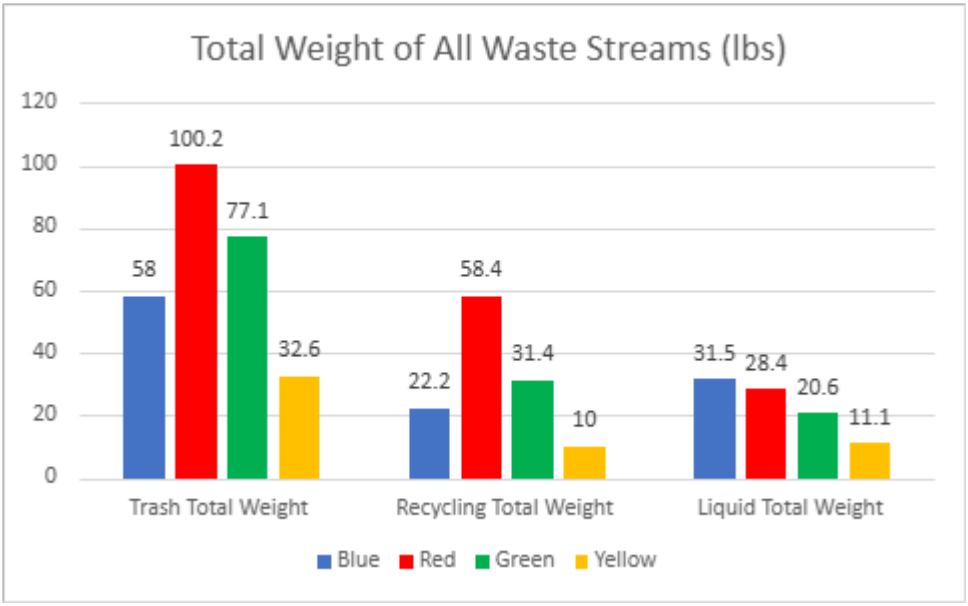

Figure 8. Total amount of waste separated by location

Caption: Total weight measured for each bin location over the two-week study period. The red bin saw the highest amount of trash and recycling weight, while the blue bin saw the highest weight of liquid disposal.

Graphic Credit: Villanova University Liquid Waste Project Team

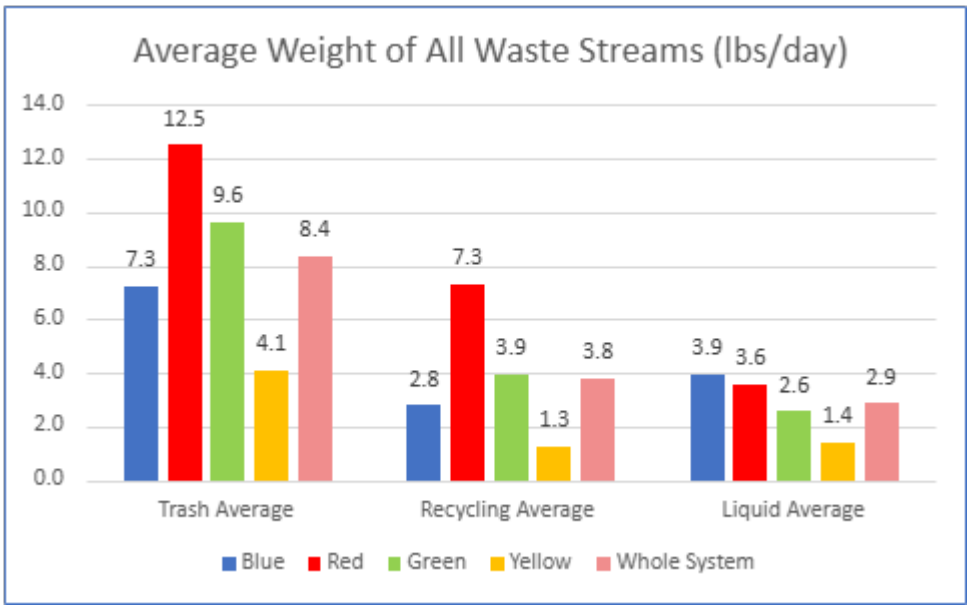

Figure 9. Average daily weight of waste streams by bin location.

Caption: Average daily weights of trash, recycling, and liquid waste were measured at each color-coded bin location on the first floor of the Engineering Building. The red station had the highest overall utilization, while the blue station recorded the highest average liquid-waste weight, exceeding the red station by 0.3 pounds. The yellow station had the lowest utilization.

Graphic credit: Villanova University Liquid Waste Project Team

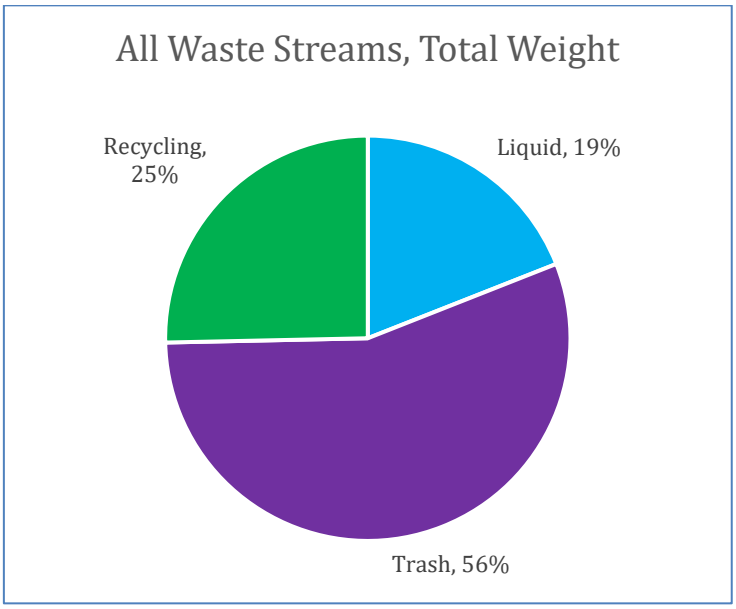

Figure 10. Measured waste-stream composition in the first-floor Engineering Building study area.

Caption: Liquid waste represented 19% of the total waste weight measured.

Graphic credit: Villanova University Liquid Waste Project Team