



## **MTP2 Summer Internship Case Study: 406 Brewing Company**

406 Brewing Company is a small, community-focused craft brewery located in Manhattan, Montana. Originally founded in Bozeman by Matt Muth, a lifelong brewing enthusiast who started as a homebrewer, the company relocated to Manhattan in 2023. Matt now runs the brewery with his brother, John Muth. 406 Brewing is known for its locally brewed beers and sustainability-minded practices. The brewery uses local ingredients (with 70% of malt sourced nearby), repurposes yeast from other breweries, and partners with local farmers for spent grain reuse. Several of its beers have won awards, and in 2025, it received the Montana Beer Awards' Community Impact Award in recognition of its environmentally conscious business operations.



### **Process Evaluation and Key Insights**

Through the Montana Pollution Prevention (MTP2) Internship Program, I worked with 406 Brewing to evaluate their operations and identify opportunities to reduce waste, conserve resources, and improve environmental performance. I conducted a targeted assessment of key brewing processes, observing how water, energy, and cleaning chemicals were used throughout the production cycle. Particular attention was given to identifying where waste was being generated and how those impacts could be reduced or eliminated. This evaluation revealed several challenges, including excessive water and energy use during the wort cooling process, high-strength wastewater discharge from spent yeast, inefficient manual cleaning practices, and a lack of flow meters for utility tracking. These issues were further constrained by limited staff time and capital for major equipment upgrades. By identifying these areas of concern, I was able to develop practical, cost-conscious recommendations to help 406 Brewing reduce pollution at the source and move toward more sustainable operations.



*Figure 1. Manual Keg Cleaning Set-up*



*Figure 2. Dumping of spent yeast*



*Figure 3. Water discharge during wort cooling*

Despite these constraints, there were clear opportunities to reduce waste, improve efficiency, and enhance sustainability through targeted P2 interventions.

## Solutions

One of the most impactful opportunities identified was the recovery of hot water discharged during wort chilling. This clean water, reaching temperatures around 160°F, is currently sent down the drain, resulting in both water and energy waste. During the assessment, we identified an unused tank on-site that could be repurposed to store this hot water. By adding a new pair of hoses, the water can be captured during chilling and directed into this storage tank. With the installation of a carbon filter, the recovered water could then be safely routed back to the Hot Liquor Tank (HLT) for reuse, retaining much of its thermal energy. This low-cost solution offers significant environmental benefits by conserving both water and the energy required to reheat it.

Another area of concern was the manual keg cleaning process, which currently consumes considerable amounts of water, CO<sub>2</sub>, and labor time. To address this, we recommended transitioning to an electric keg washer. This equipment would dramatically reduce the water and CO<sub>2</sub> used per cleaning cycle and free up staff time for other tasks. Though the initial investment is moderate, the long-term resource savings and labor efficiency make it a practical and sustainable upgrade for a small operation like 406 Brewing.

For yeast disposal, I explored alternatives to the current practice of dumping spent yeast down the drain, which contributes to high BOD and COD levels in brewery effluent. I reached out to YES Compost, a local composting company, which agreed to pick up the spent yeast weekly. They will provide a dedicated tub to store the yeast, which will be pressure-cleaned after each pickup. The service will be billed at \$50 per month, but the plan is flexible: in weeks when brewing doesn't occur and no yeast is generated, 406 can notify YES Compost and receive a credit toward future pickups, making this a cost-effective and environmentally responsible solution.

Finally, to support long-term efficiency improvements, I recommended that 406 Brewing install flow meters and implement a structured utility tracking system. Currently, water and energy use are estimated rather than measured, which limits the brewery's ability to monitor its resource efficiency and calculate return on investment for sustainability upgrades. Accurate metering will allow for better decision-making, enable clearer tracking of trends, and help the brewery quantify the benefits of future interventions.

Recommended P2 Actions	If Implemented:							If Not Implemented	
	\$		Annual Reductions						
	One-time cost to implement (\$)	Annual savings from P2 actions	Water Use (gal)	CO2 use (lbs)	Solid Waste Pollution (lbs)	Solid Organic Waste Pollution (lbs)	Time (hrs)	Barrier to Implement	Plans to implement within 5 years? (Y/N)
Wort Cooling Water Recovery	500	74.26	25,608	-	-	-	-	Funds	Y
Keg Washer	12,000	1362.85	3,600	135	-	-	66	Funds	Y
Composting Spent Yeast	50/mont	-	-	-	-	1680	-		Y

**Table 1. P2 ecommended actions with reduction and cost analysis**