



WORLD BREWING CONGRESS

August 13–17, 2016 • Denver, Colorado, U.S.A.

#ElevateBeer

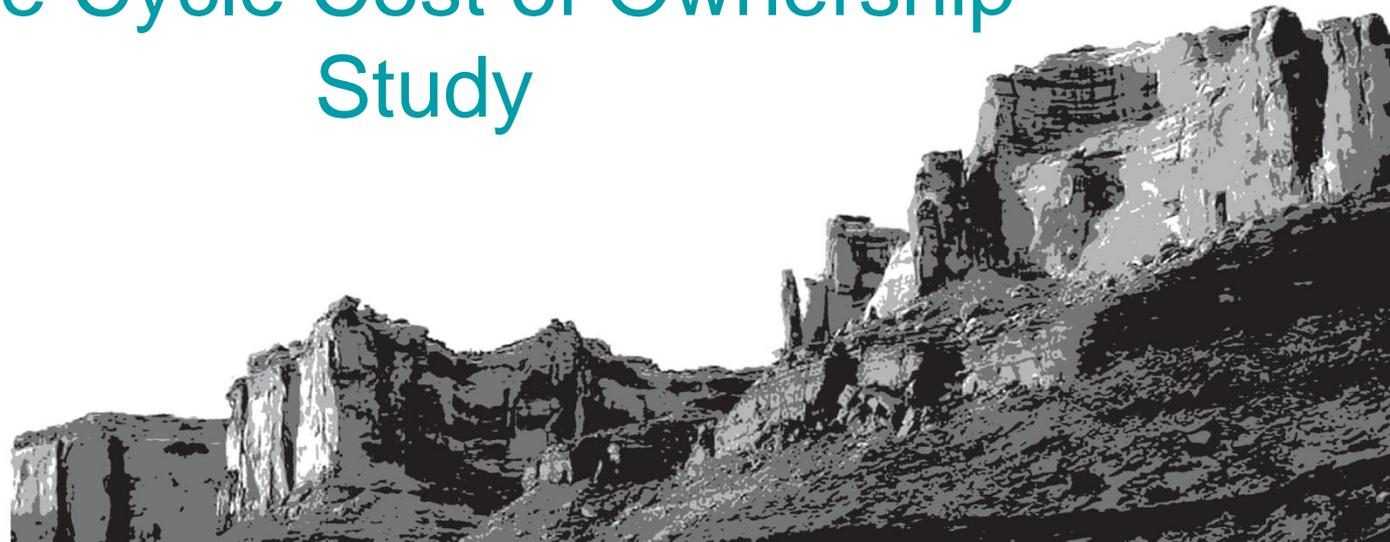


Sustainable Wastewater Pretreatment at Bell's Brewery

A Life Cycle Cost of Ownership Study



Inspired Brewing®





Talk Overview

- Level 201 Wastewater Talk
- Is Pretreatment Sustainable for Bell's?
- Ecologically...
 - Sustainability @ Bell's Brewery
 - Ecological Impacts of Brewery Effluent
- Operational Design and Performance
- Financially...
 - Lifecycle Cost Analysis
 - Lessons Learned
- Questions





What is “Sustainability” at Bell’s

- “The ability to meet today’s operational needs without compromising our ability to do so for an indefinite period of time”
- “Operational Needs” = Capital
 - Social
 - Environmental
 - Financial





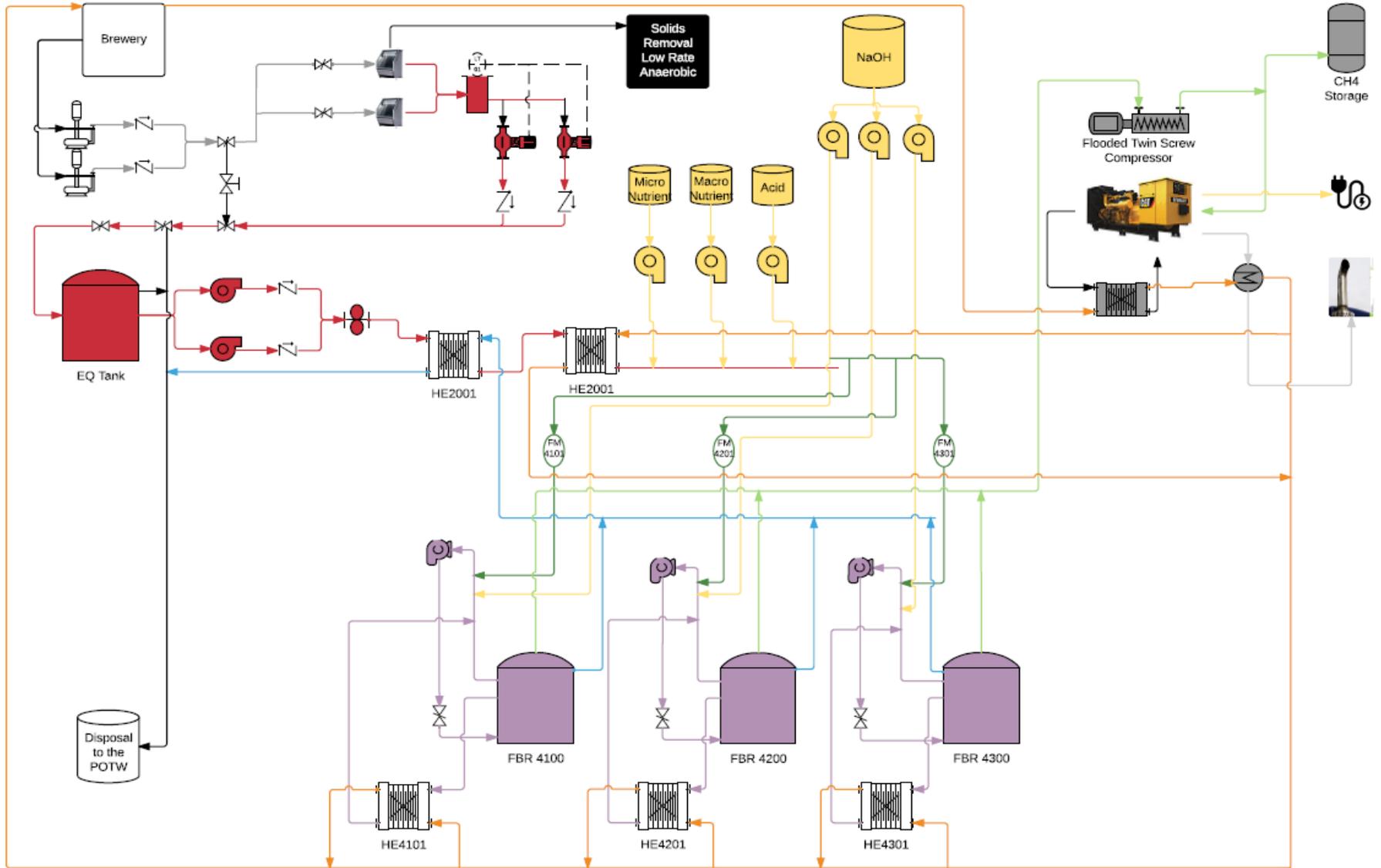
Brewery Wastewater Impacts

Approximate Daily Maximums

	Untreated Brewery Wastewater	Target NPDES Discharge
BOD (mg/l)	14,000	200
TSS (mg/l)	6,200	200
Phosphorus (mg/l)	100	1
pH	11.9	9



"The Cube"



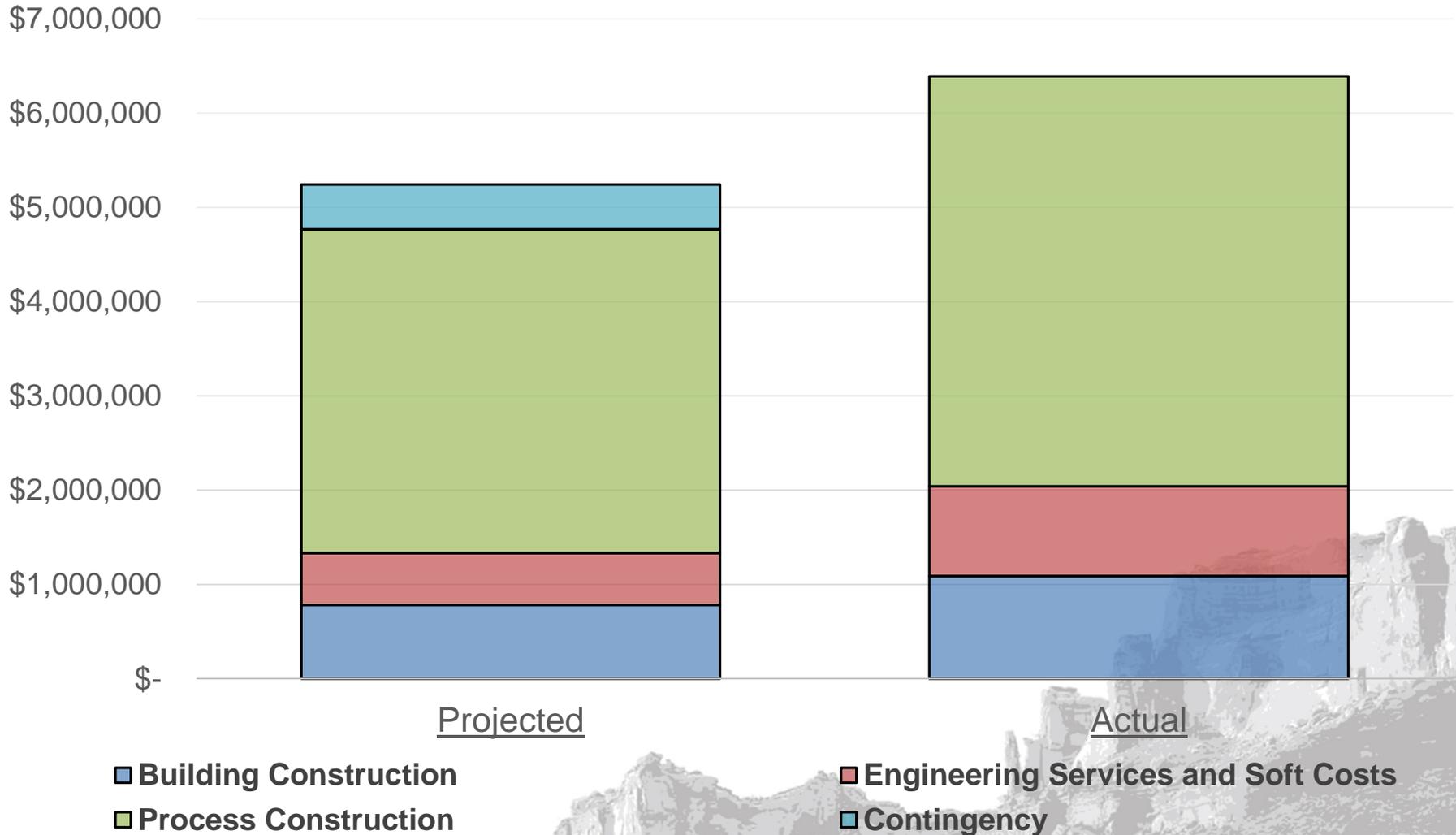


Removal Efficiencies

2015	COD (mg/l)		BOD (mg/l)	
	Cube Influent	Cube Effluent	Cube Influent	Cube Effluent
4/27/2015	10215	2140	7252	684
4/28/2015	10665	2420	7572	774
4/29/2015	9690	3030	6879	969
4/30/2015	9495	2410	6741	771
9/28/2015	5130	1665	3642	532
9/29/2015	7080	1750	5026	560
9/30/2015	9420	2565	6688	820
10/1/2015	10920	1850	7753	592
11/9/2015	9660	2285	6858	731
11/10/2015	11355	2195	8062	702
11/11/2015	11310	3145	8030	1006
11/12/2015	11130	1765	7902	564
Mean (n = 12)	9673	2268	6867	725
Removal Efficiency	77%		91%	
NPDES Target Removal Efficiency	97%			

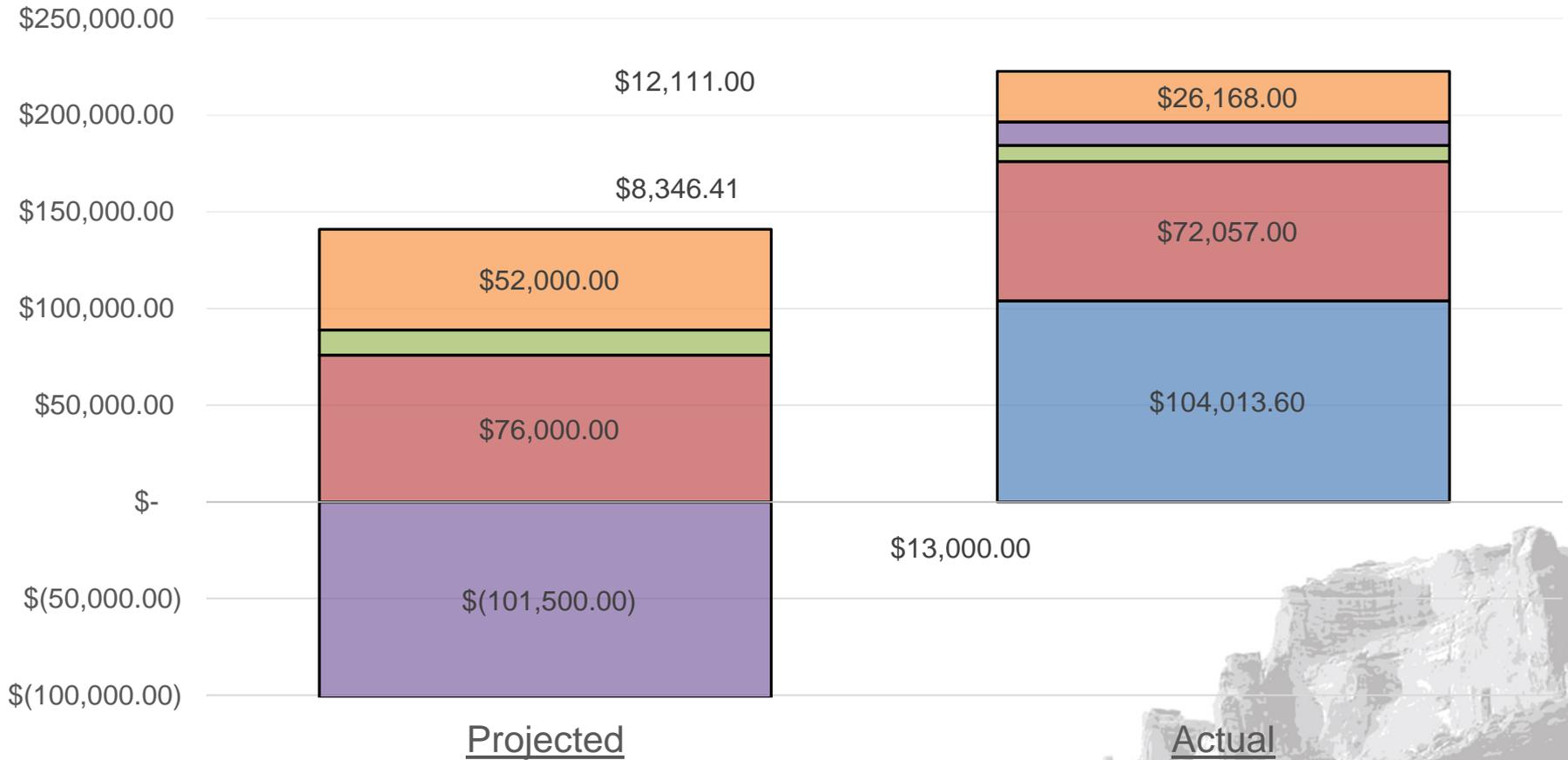


Capital Costs





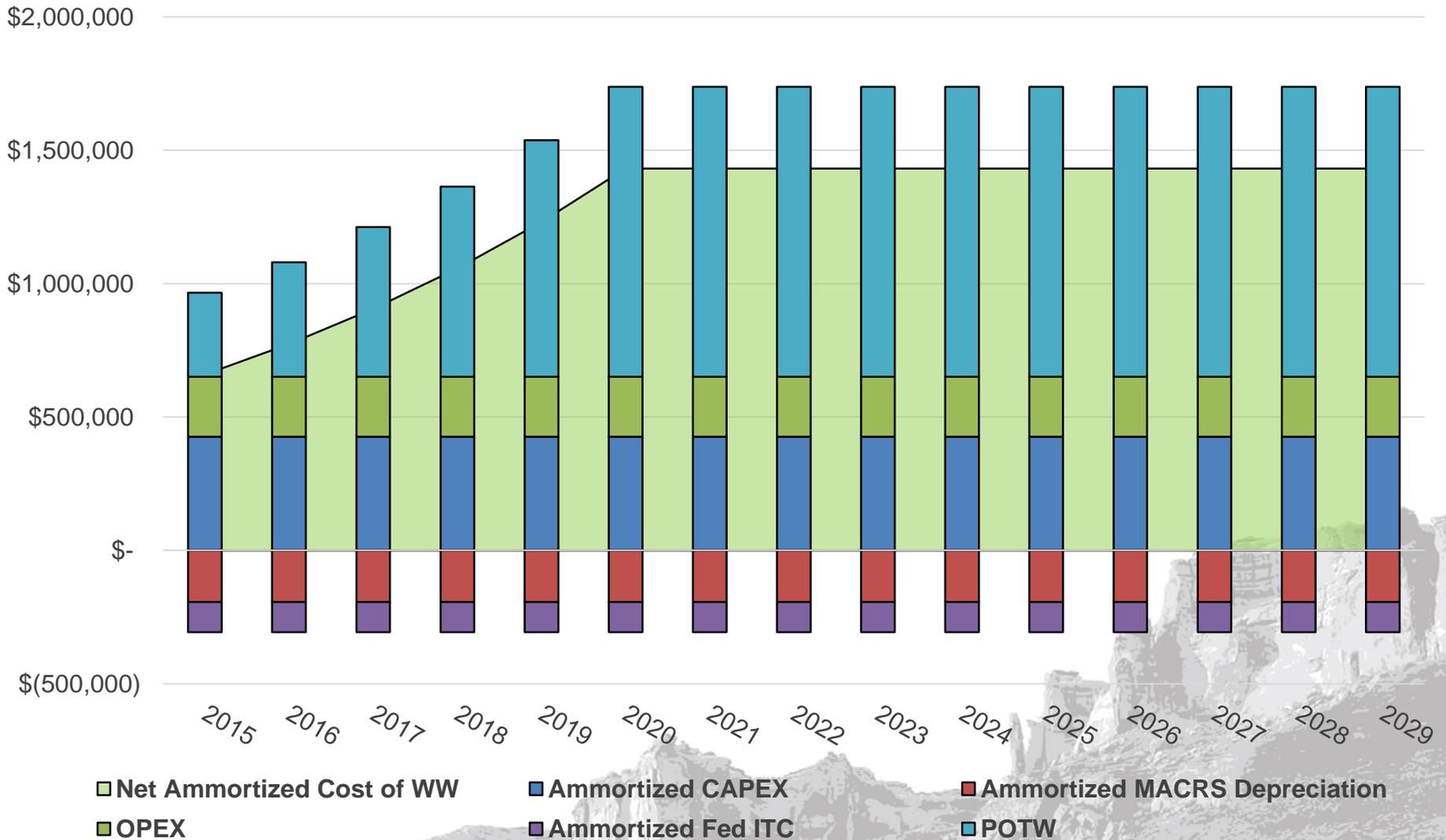
Operating Costs



■ Labor & Mgmt
 ■ Chemicals
 ■ CHP Maintenance
 ■ Net Power Production
 ■ Solids Hauling

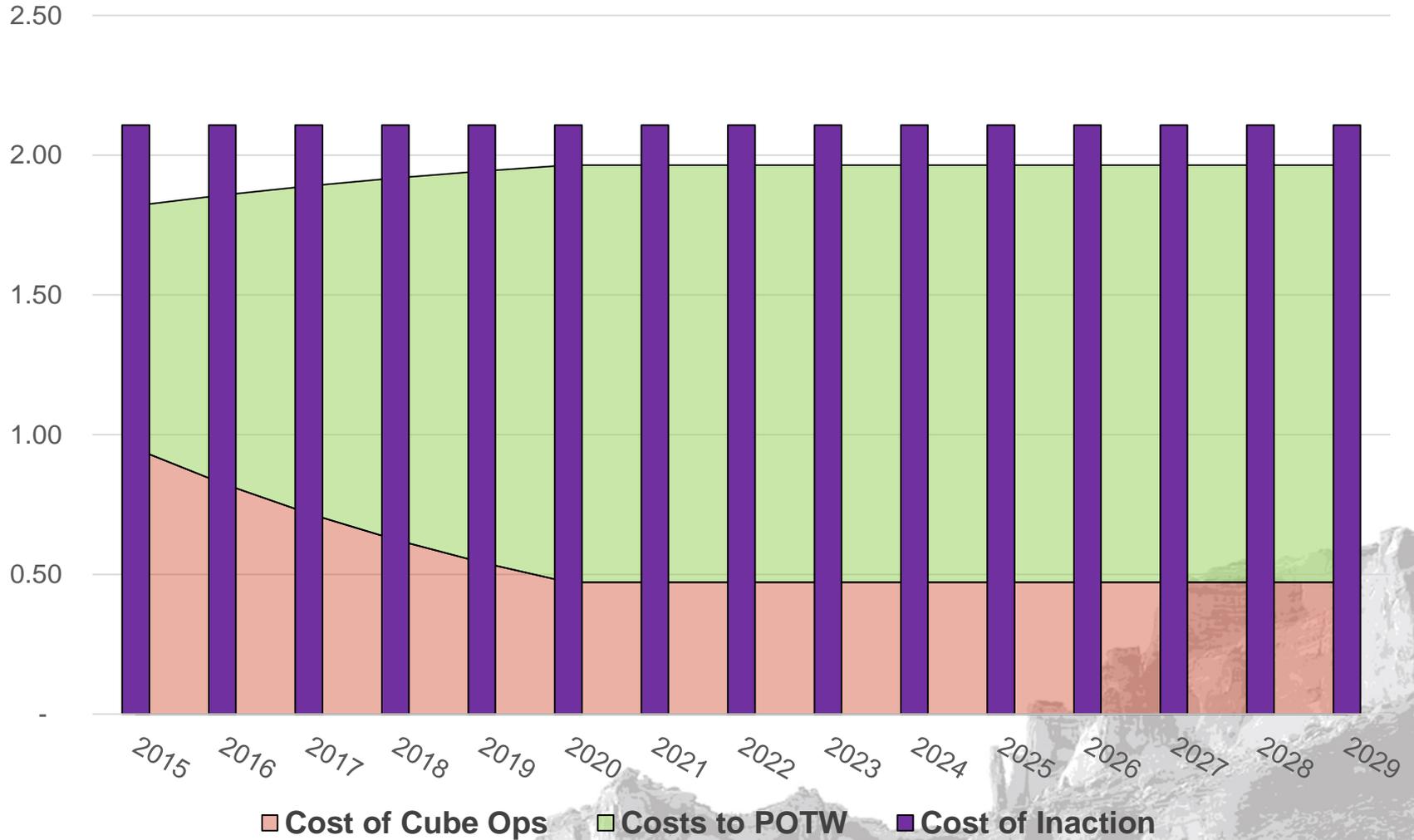


Lifecycle Cost of Ownership



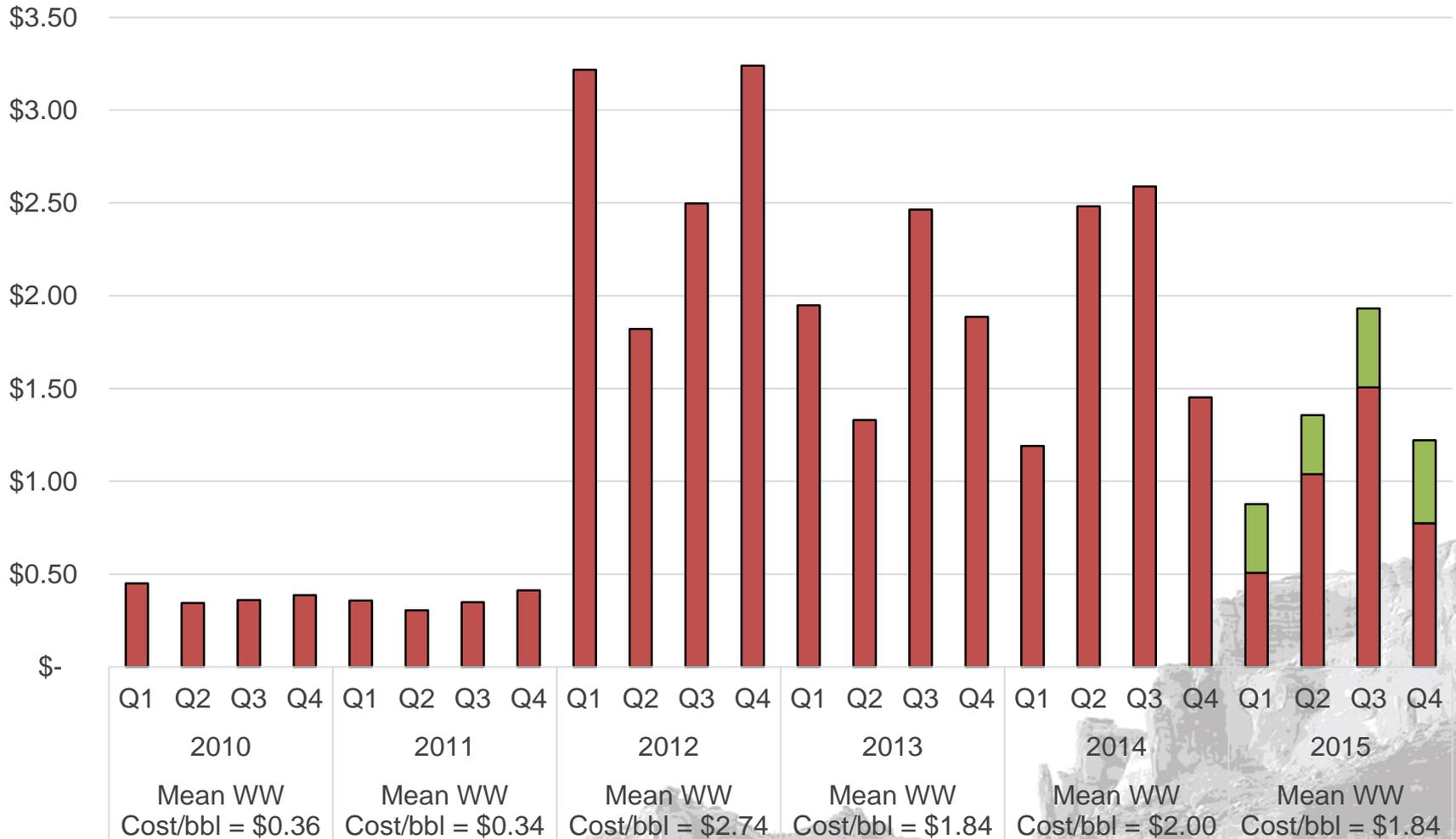


Wastewater Costs per Bbl Pkg'd



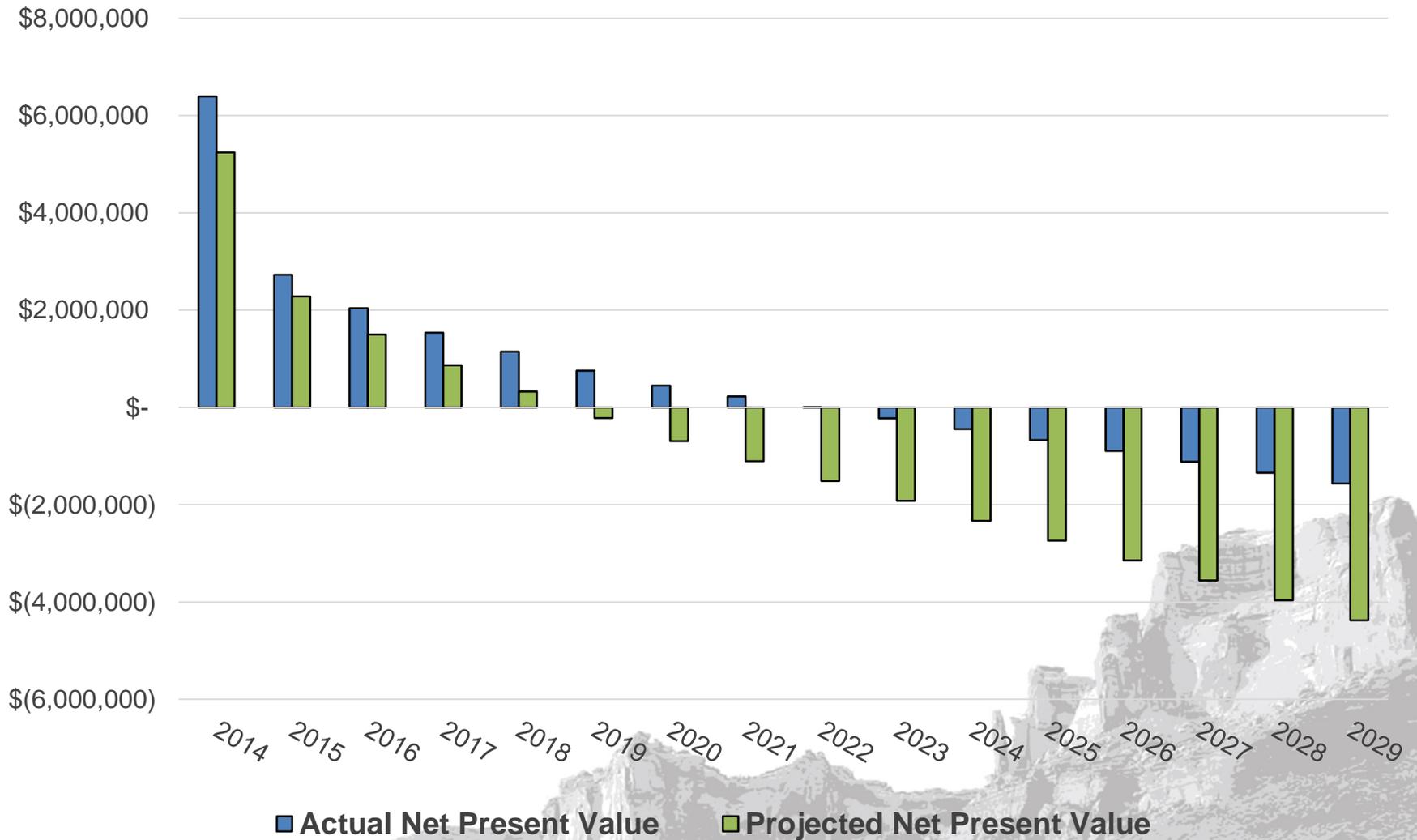


Historical Cost of Wastewater





Return on Investment





Lessons Learned

- Inverse relationship between contract pricing details and change order costs.
- Wastewater pretreatment is completely different than energy generation.
 - Let savings drive design
- Account for labor and management costs.
- Minimize chemical operating costs in the design.
- Don't underestimate the solids that come out of a craft brewery.
 - Pre-Project Sampling: Sippers don't suck



Questions

