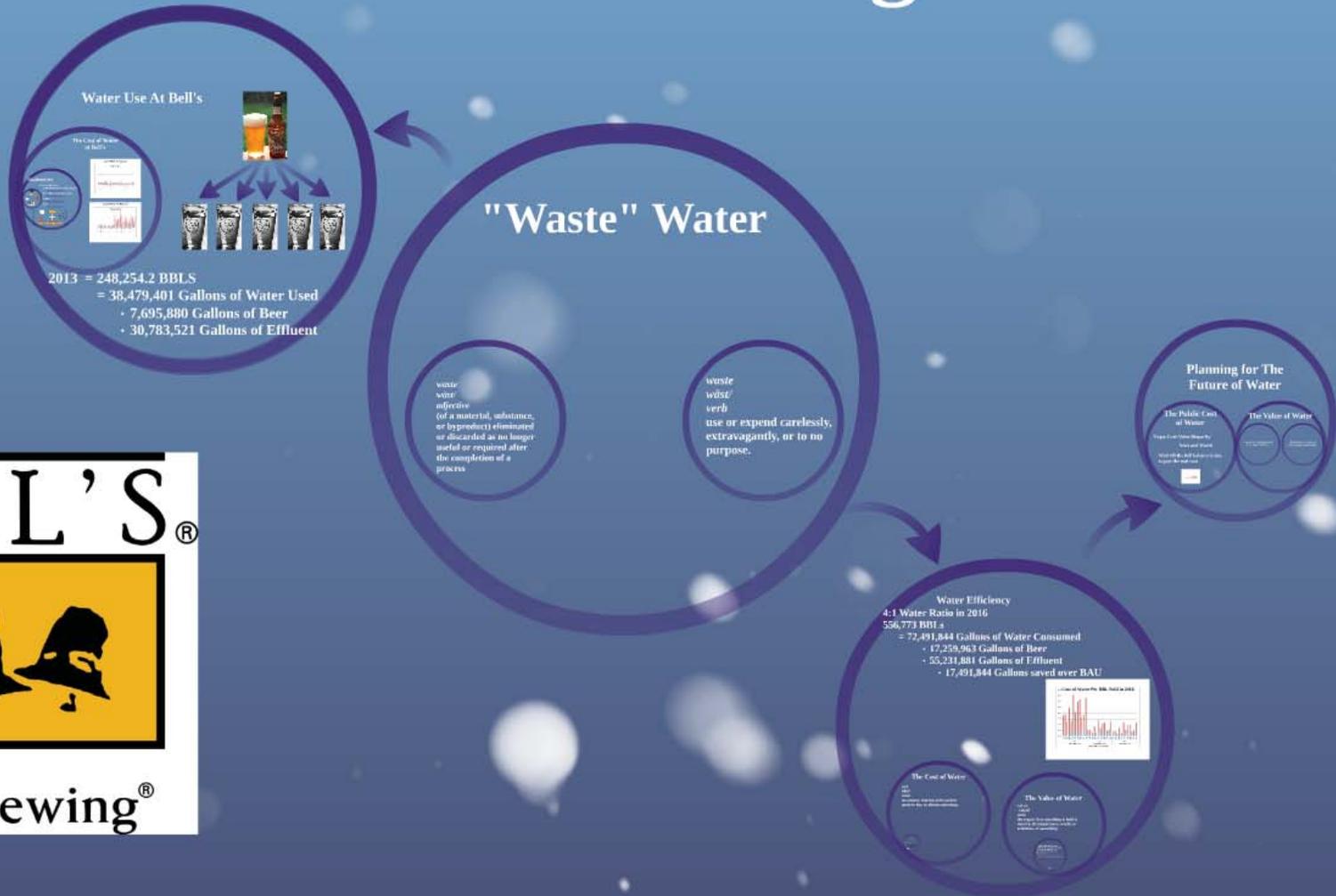
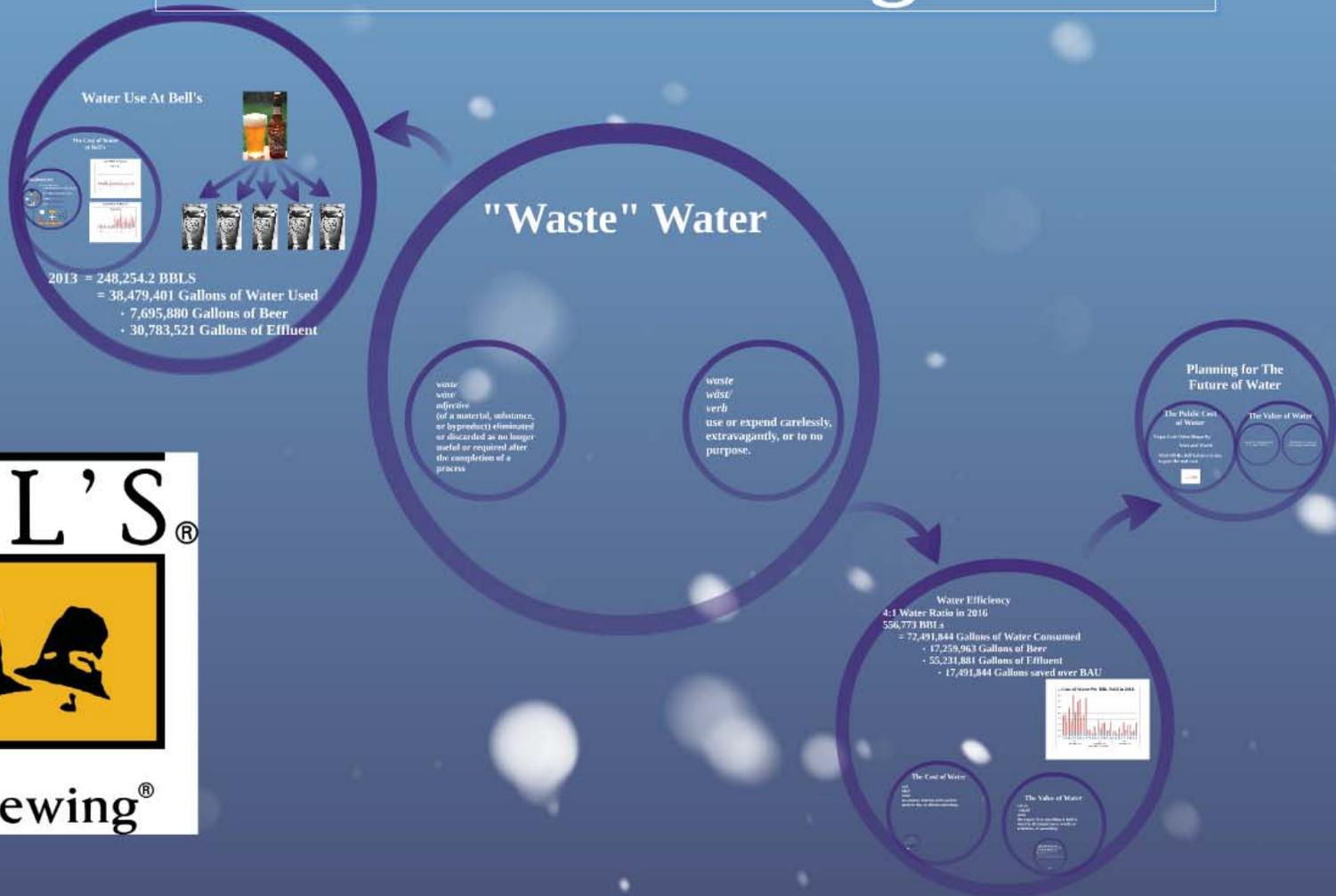


Sustainable Water Use in Brewing



Sustainable Water Use in Brewing



"Waste" Water



Used
r
fluent

waste
wāst/
adjective
(of a material, substance,
or byproduct) eliminated
or discarded as no longer
useful or required after
the completion of a
process

waste
wāst/
verb
use or expend carelessly,
extravagantly, or to no
purpose.

waste

wāst/

adjective

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or byproduct) eliminated
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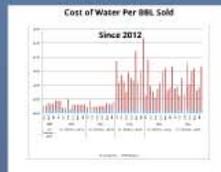
Water Use At Bell's



The Cost of Water at Bell's

Biochemistry

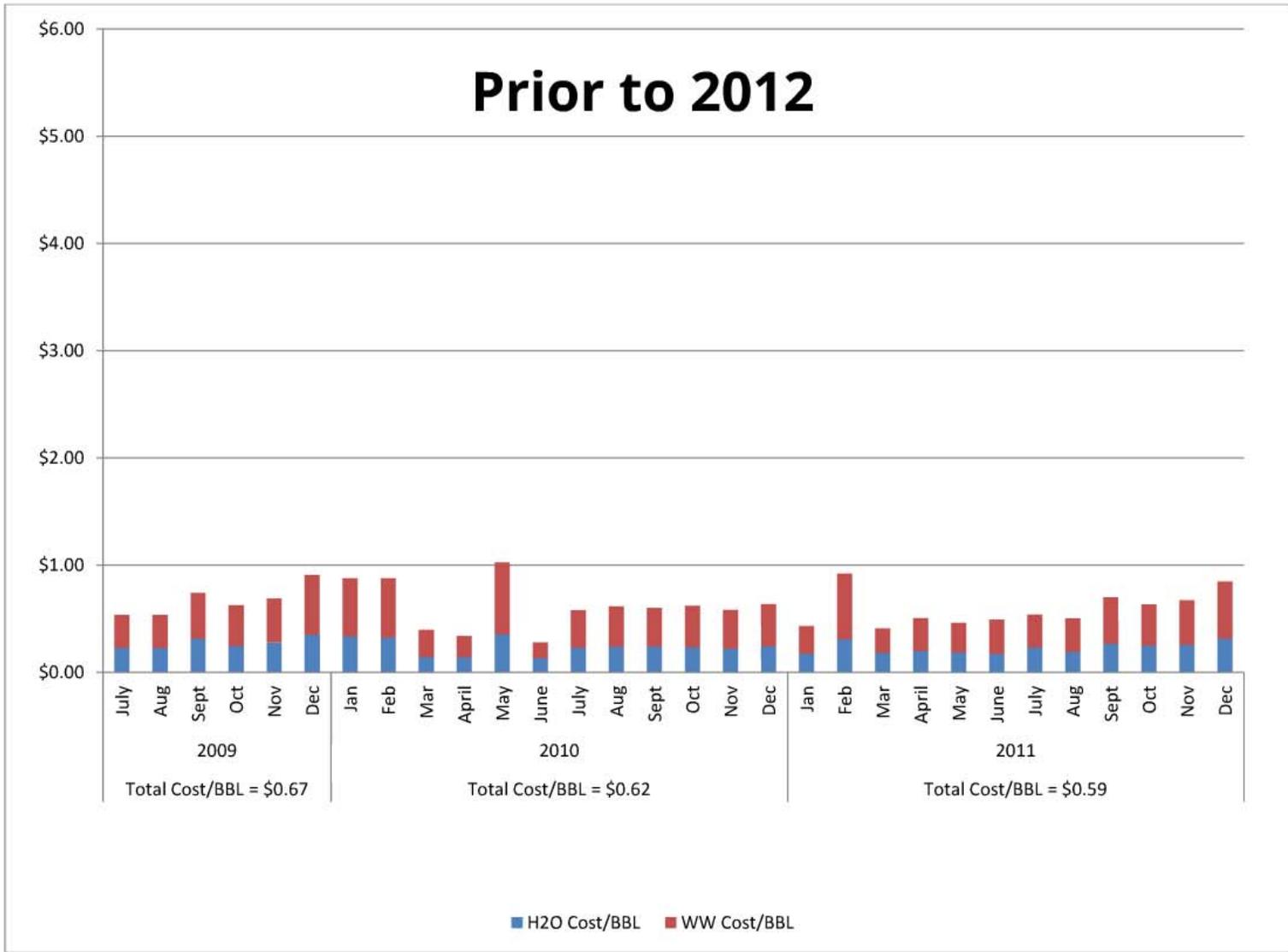
We Are Billed For:
- BOD (Biological Oxygen Demand)
- TSS (Total Suspended Solids)
- Volume
- NH4



2013 = 248,254.2 BBLs
= 38,479,401 Gallons of Water Used
• 7,695,880 Gallons of Beer
• 30,783,521 Gallons of Effluent

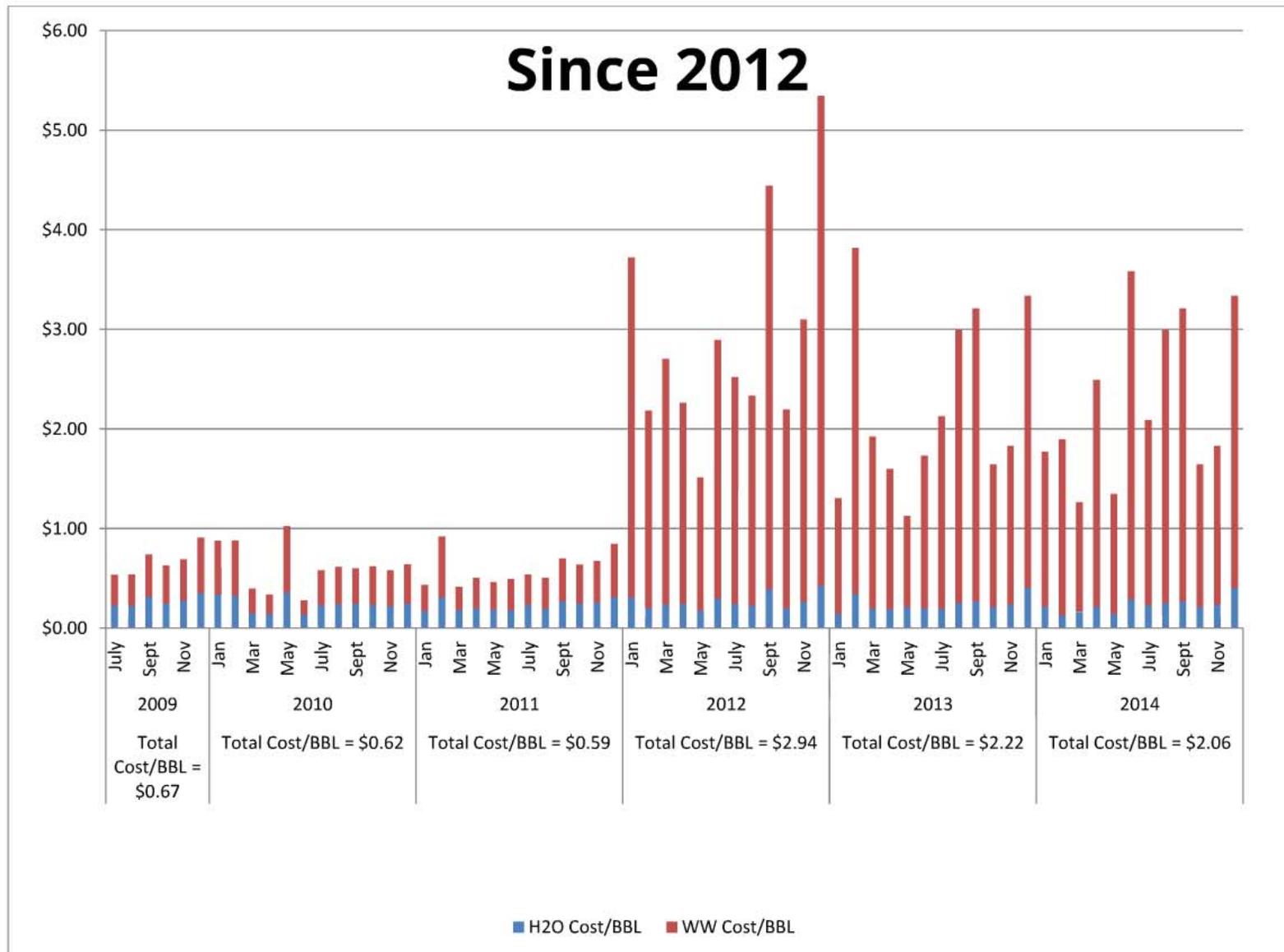
Cost of Water Per BBL Sold

Prior to 2012



■ H2O Cost/BBL ■ WW Cost/BBL

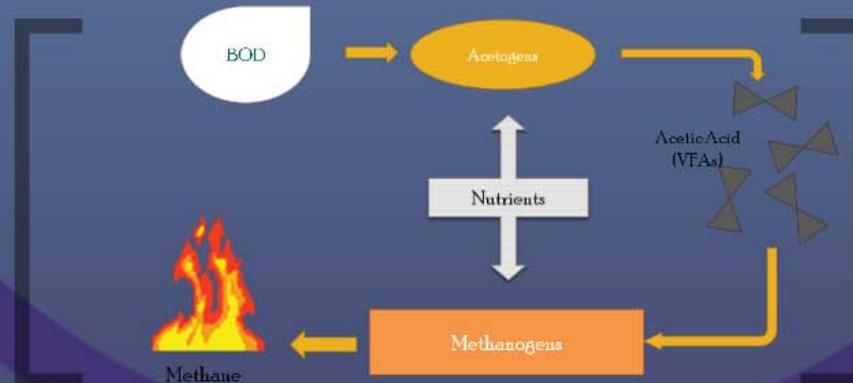
Cost of Water Per BBL Sold



Biochemistry

We Are Billed For:

- BOD (Biological Oxygen Demand)
 - 60% of Total Cost
- TSS (Total Suspended Solids)
 - 27% of Total Cost
- Volume
 - 10% of Total Cost
- NH₄
 - 3% of Total Cost



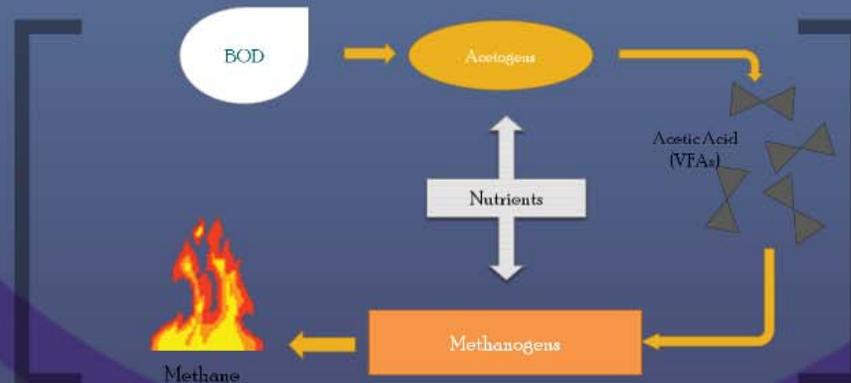
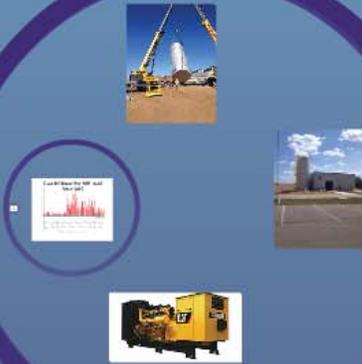
PLEASE

KILL ME NOW

Biochemistry

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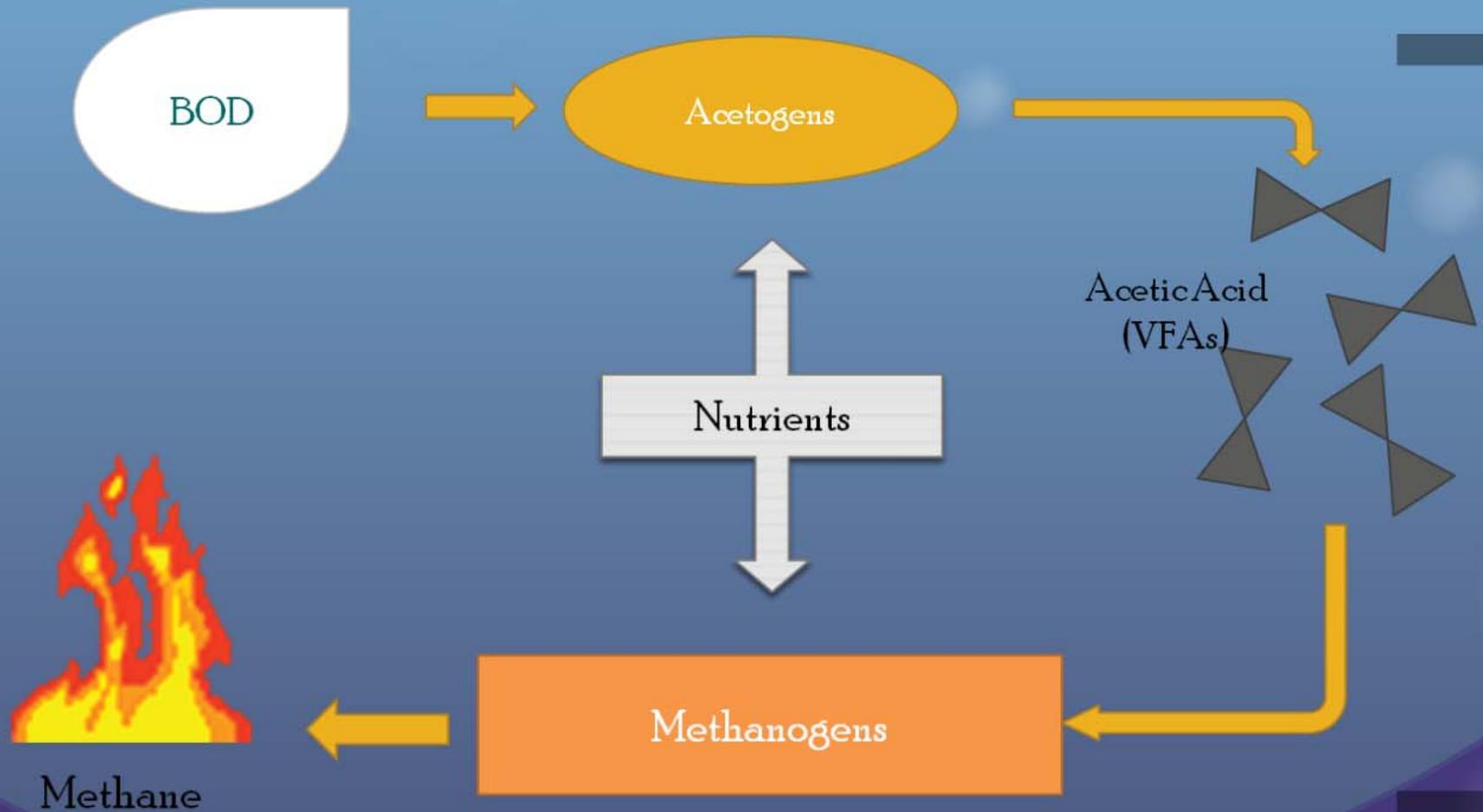
chemistry

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- **BOD (Biological Oxygen Demand)**
 - **60% of Total Cost**
- **TSS (Total Suspended Solids)**
 - **27% of Total Cost**
- **Volume**
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 - **3% of Total Cost**



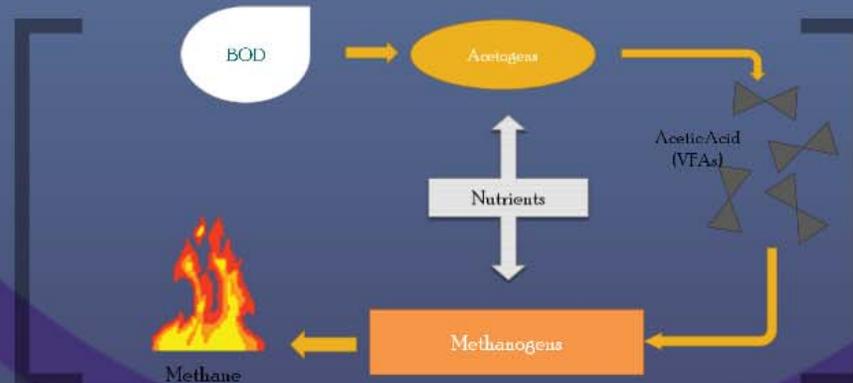
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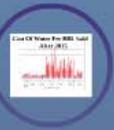




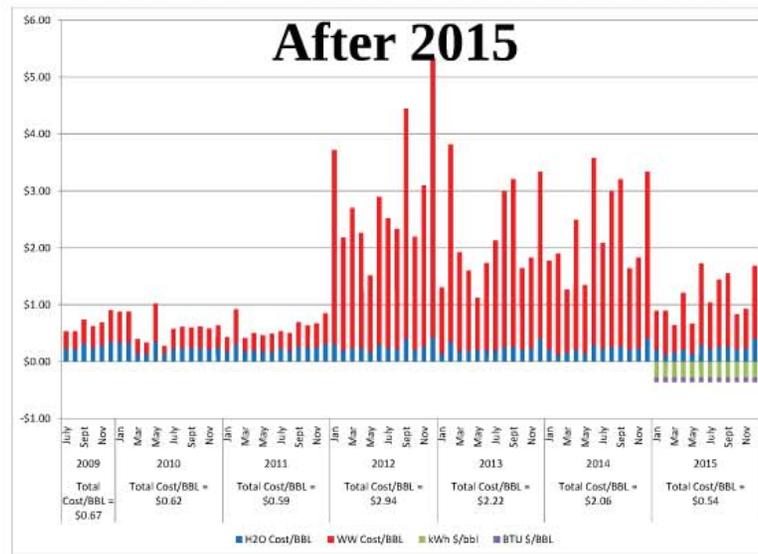
- TS

- Vo

- NI

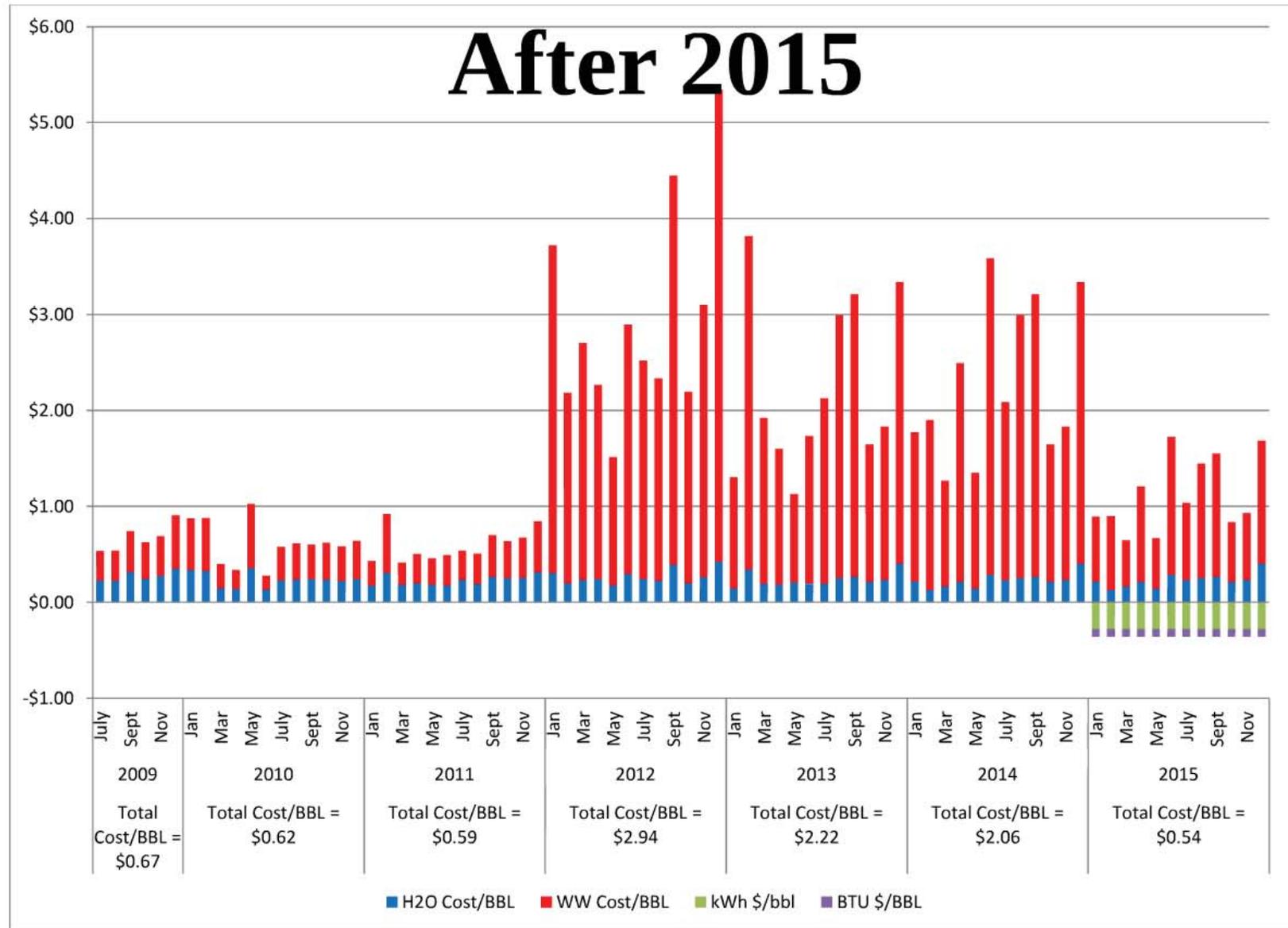


Cost Of Water Per BBL Sold After 2015

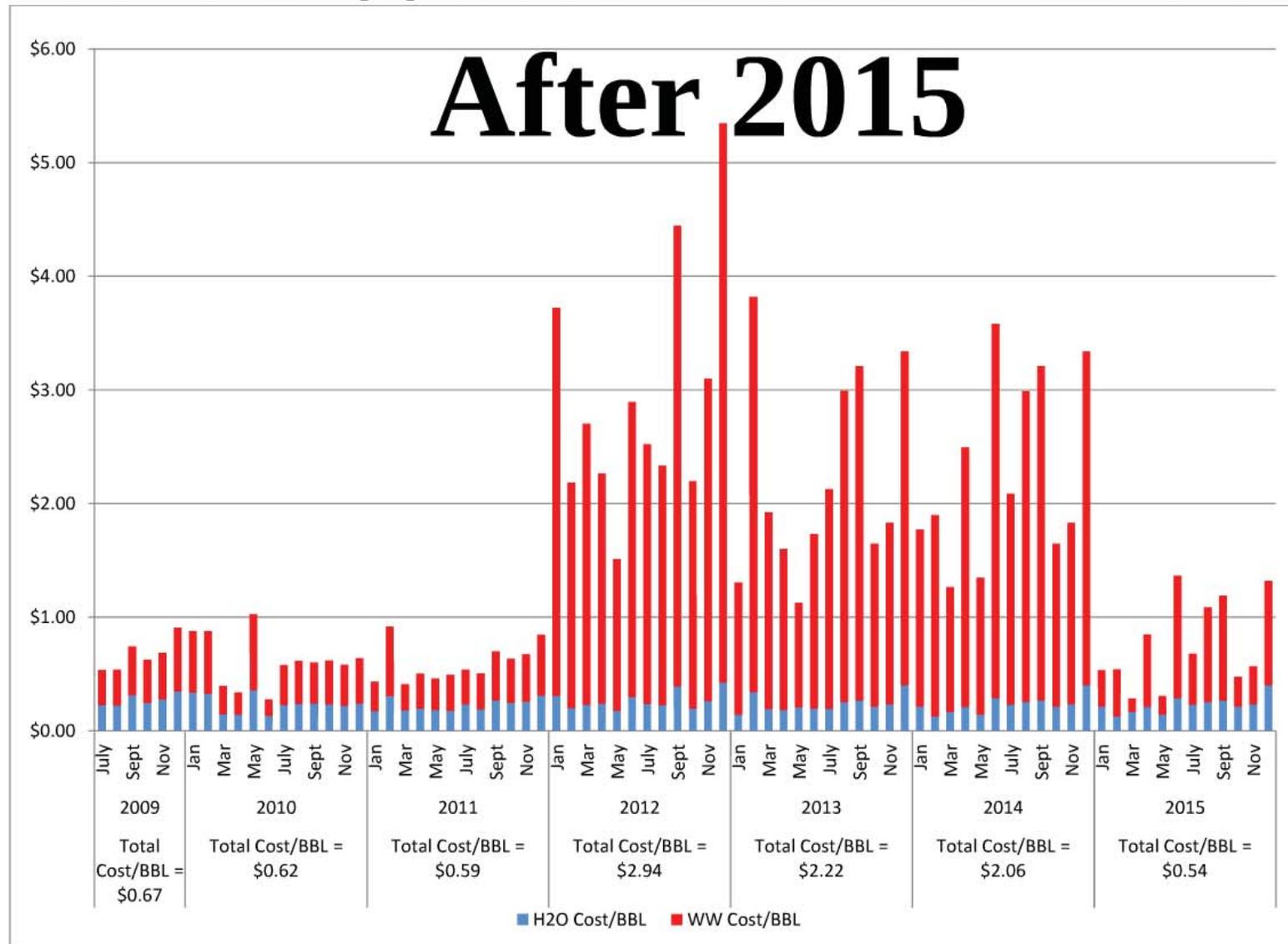


Cost Of Water Per BBL Sold

After 2015



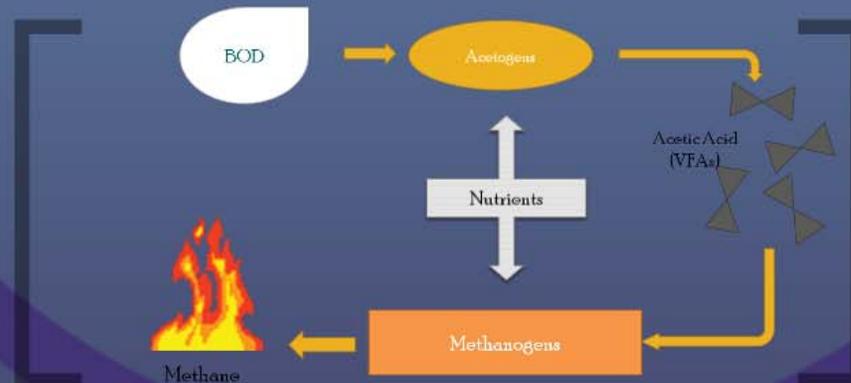
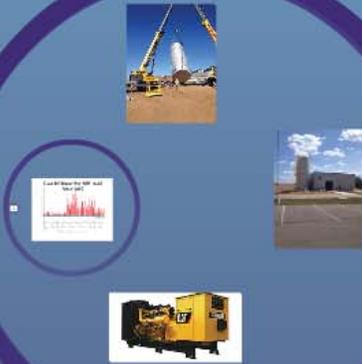
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Biochemistry

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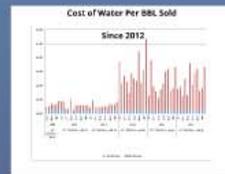
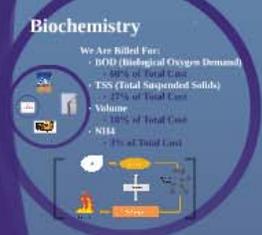
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Water Use At Bell's



The Cost of Water at Bell's



2013 = 248,254.2 BBLs
= 38,479,401 Gallons of Water Used

- 7,695,880 Gallons of Beer
- 30,783,521 Gallons of Effluent

Water Efficiency

4:1 Water Ratio in 2016

556,773 BBLs

= 72,491,844 Gallons of Water Consumed

- 17,259,963 Gallons of Beer
- 55,231,881 Gallons of Effluent
- 17,491,844 Gallons saved over BAU



The Cost of Water

cost
kōst/
noun
an amount that has to be paid or
spent to buy or obtain something.



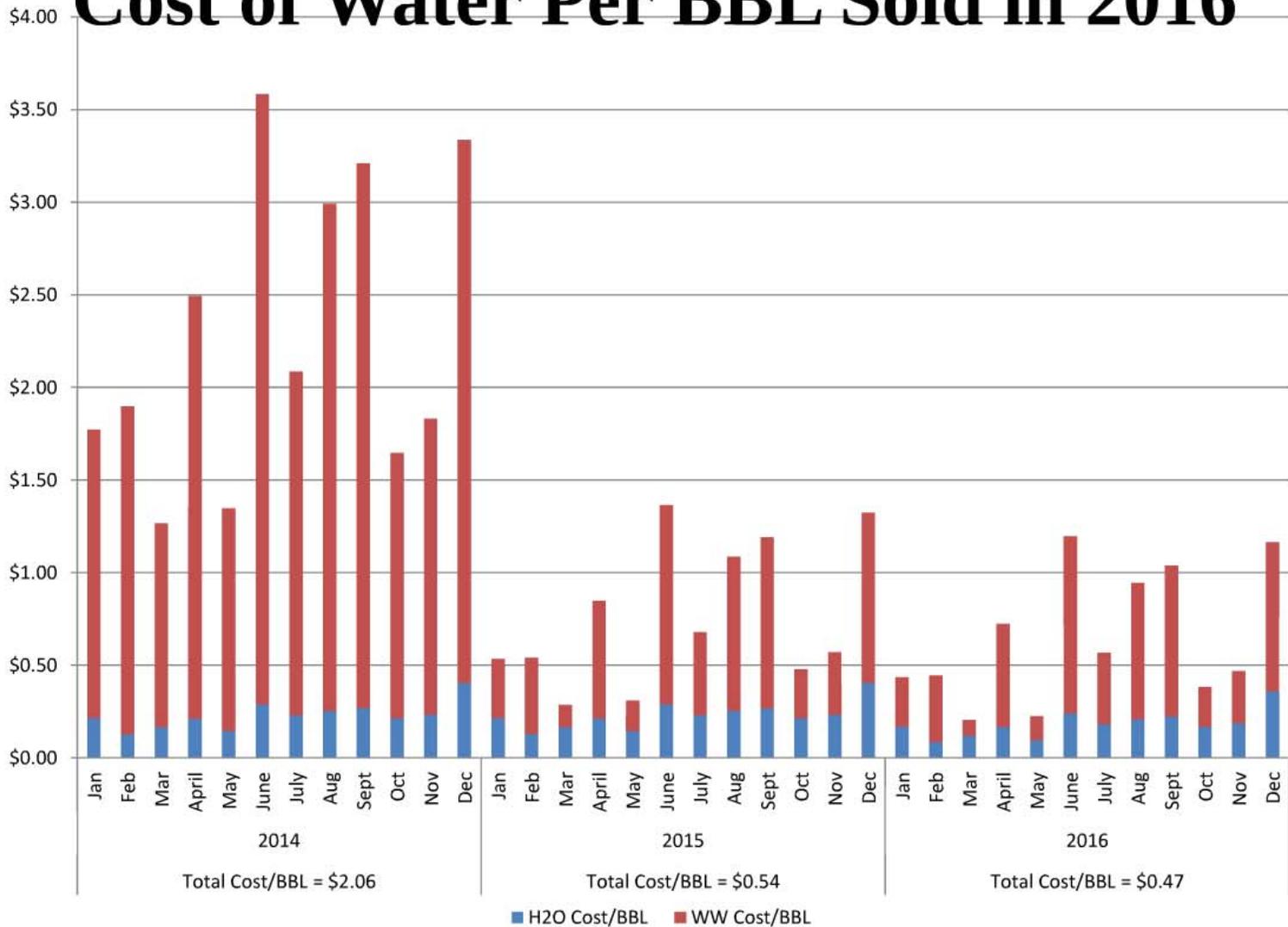
The Value of Water

val-ue
'valyoō
noun
the regard that something is held to
deserve; the importance, worth, or
usefulness of something.

"The fundamental insight
is that in the long run, there are no
substitutes for water, and that
the most important factor in
the production and growth of our
economy is water."

- Tom McSwack, California State
Assembly Member, Executive Director

Cost of Water Per BBL Sold in 2016



The Cost of Water

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kôst/

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The Value of Water

val·ue

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the regard that something is held to deserve; the importance, worth, or usefulness of something.

The Cost of Water

- Bottled Water = \$1.63/Gallon
- US Tap Water*
- Max = \$0.81/Gallon
- Min = \$0.002/Gallon
- Min = \$0.002/Gallon



"If this [Californian] drought continues for two, three more years, that could greatly impact the production and growth of our breweries,"

- Tom McCormick, California Craft Brewers Association, Executive Director.



The Cost of Water

cost

kôst/

noun

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The Cost of Water

- Bottled Water = \$1.63/Gallon
- US Tap Water*

* Data from Center of Water Policy survey of 30 U.S. Cities

- Max = \$0.91/Gallon
- Mean = \$0.905/Gallon
- Min = \$0.902/Gallon



The Cost of Water

- **Bottled Water = \$1.63/Gallon.**
- **US Tap Water***

* - Data from Circle of Blue price survey in 30 US Cities

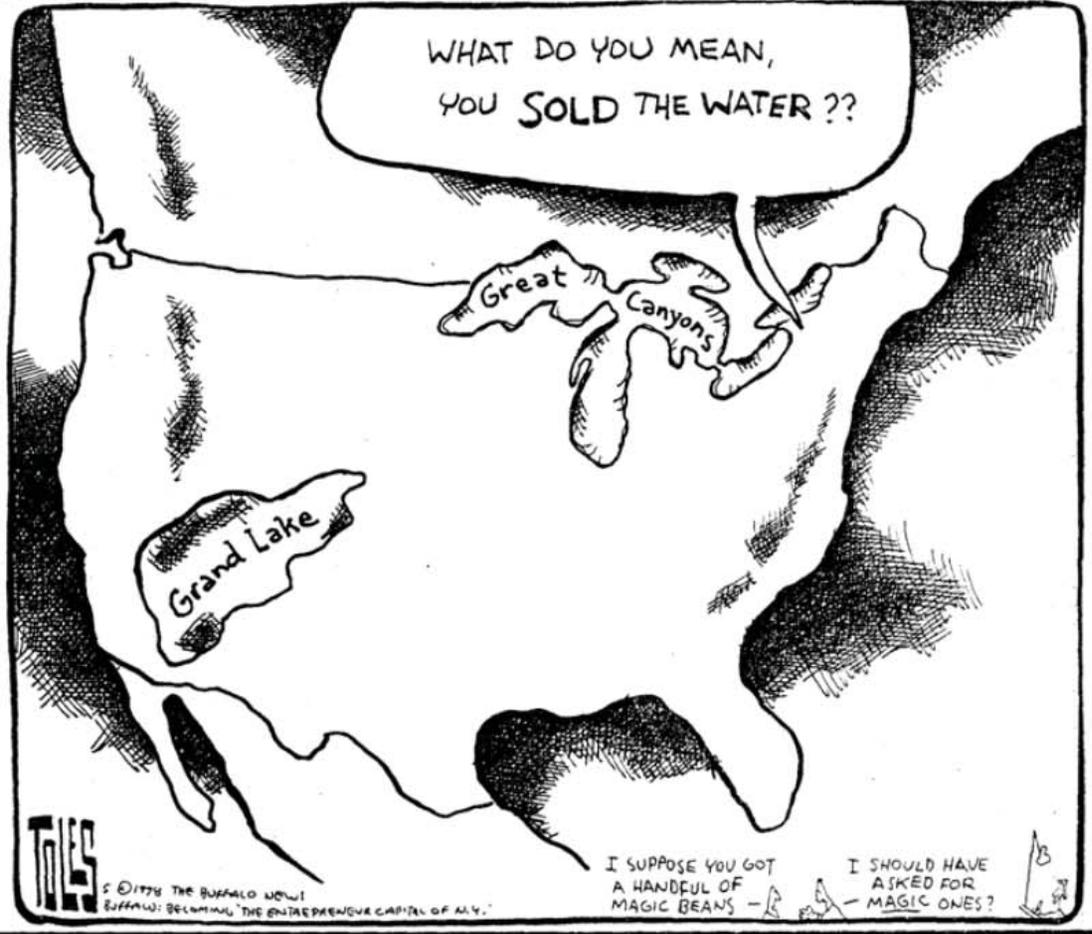
- **Max = \$0.01/Gallon**
- **Mean = \$0.005/Gallon**
- **Min = \$0.002/Gallon**



The Great Lakes & Great Lakes Compact



May 13, 1998



The Cost of Water

cost

kôst/

noun

an amount that has to be paid or spent to buy or obtain something.

The Value of Water

val·ue

'valyoō

noun

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"We have a water cap of 8 million gallons a year, and that's really affected our growth,"
- Peter Kruger, Head brewer, Bear Republic.

Bell's Operates at 5.1:1 Water Ratio
Max Potential Capacity = 52,287 HBLS
A.K.A. Bell's since 2004



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- Peter Kruger, Head brewer, Bear Republic.

Bell's Operates at 5.1:1 Water Ratio
Max Potential Capacity = 52,287 BBLs
a.k.a - Bell's circa 2004

"Most won't say it, but water is a major reason craft beer behemoths such as Sierra Nevada and New Belgium opened plants in Asheville. It's no coincidence that big brewers are congregating around the Smoky Mountains' substantial water supply."
- Harry Schuhmacher, Publisher Beer Business Daily

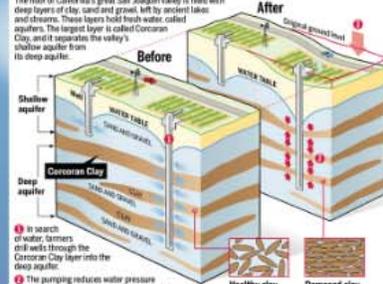


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Sinking ground

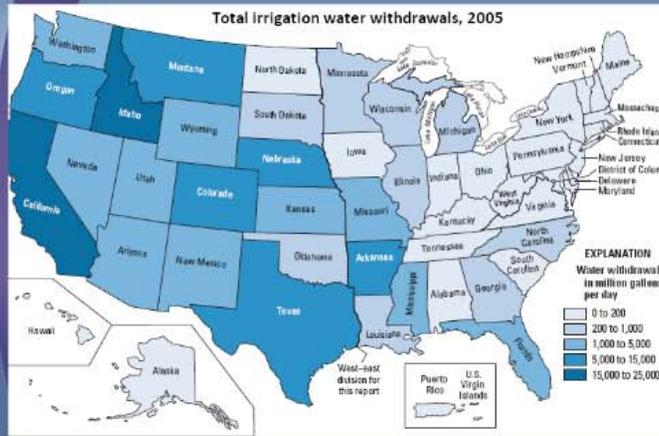
The floor of California's great San Joaquin Valley is filled with deep layers of clay, sand and gravel, left by ancient lakes and streams. These layers hold fresh water, called aquifers. The largest layer is called Corcoran Clay, and it separates the valley's shallow aquifer from its deep aquifer.



- 1 In search of water, farmers drill wells through the Corcoran Clay layer into the deep aquifer.
- 2 The pumping reduces water pressure and causes the layers' loose clay particles to compact, stacking the particles. The sand and gravel layers are unaffected.
- 3 The heavy ground above them collapses.

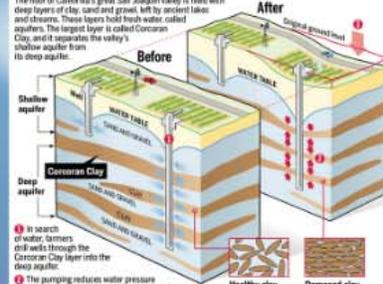
Healthy clay
The granular structure of healthy clay is filled with water.

Damaged clay
Once the clay compacts, it can never be repressured, permanently losing its future water storage.



Sinking ground

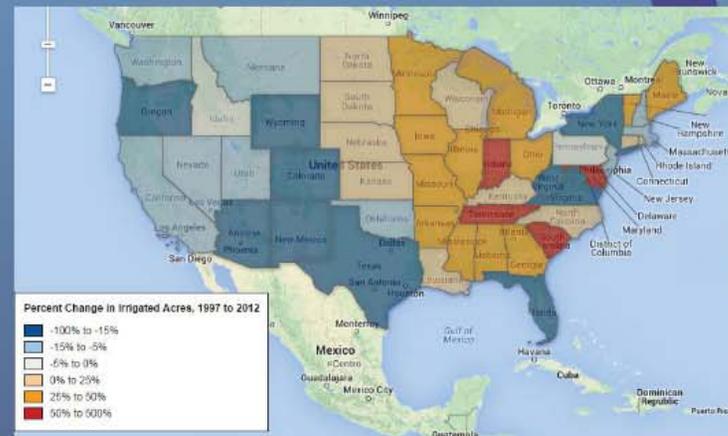
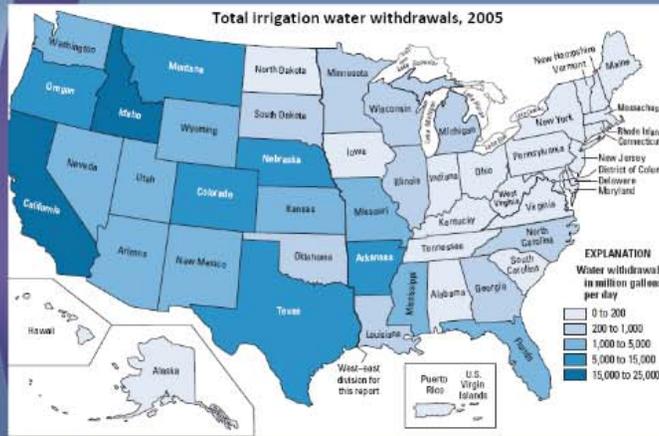
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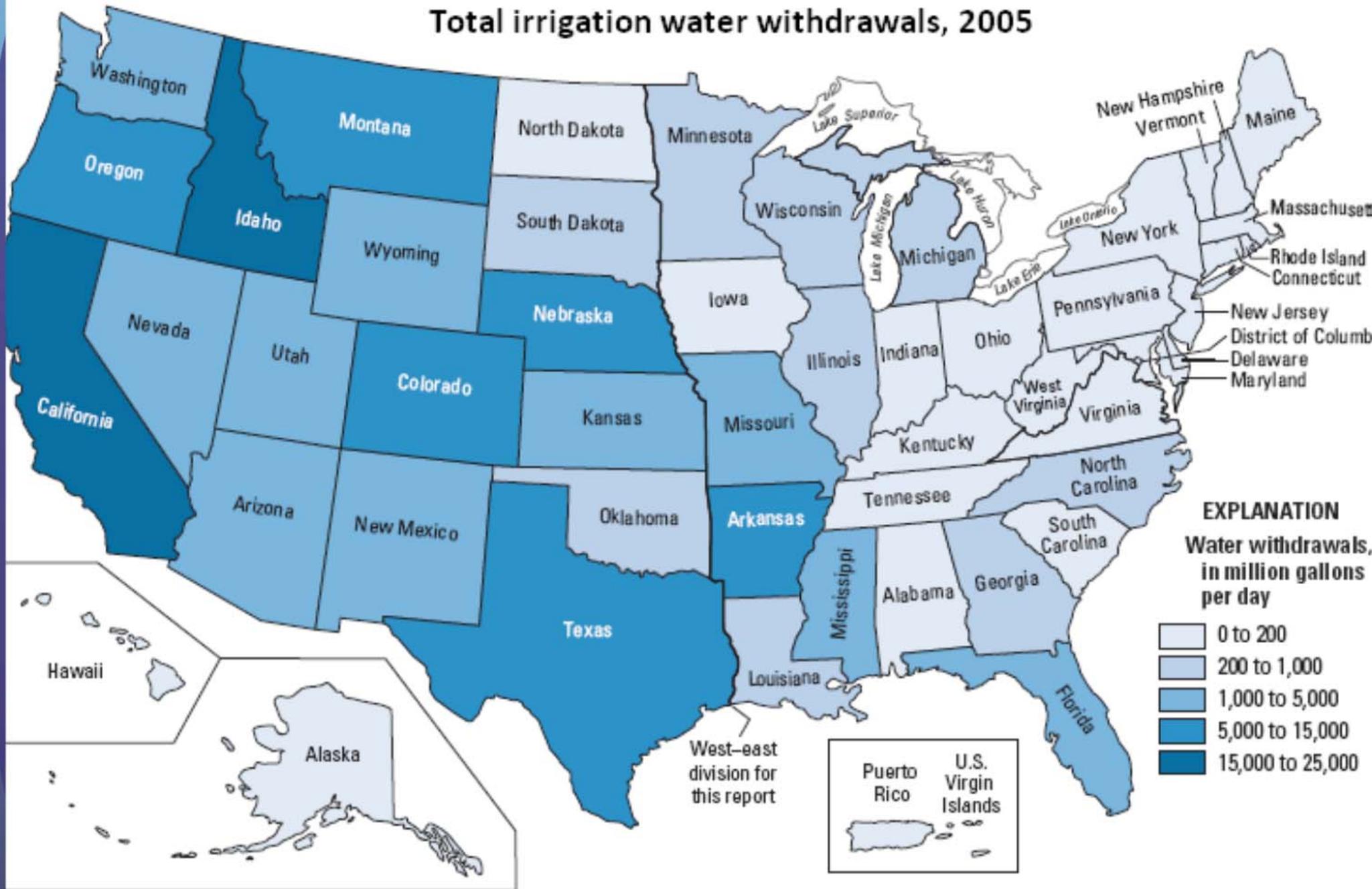
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Total irrigation water withdrawals, 2005



Washington

Oregon

California

Nevada

Arizona

Utah

New Mexico

Wyoming

Colorado

Montana

Nebraska

Kansas

Oklahoma

Texas

North Dakota

South Dakota

Minnesota

Iowa

Missouri

Arkansas

Louisiana

Lake Superior

Lake Michigan

Lake Huron

Lake Erie

Lake Ontario

Wisconsin

Michigan

Illinois

Indiana

Ohio

Kentucky

Tennessee

Mississippi

Alabama

Georgia

Florida

West Virginia

Virginia

North Carolina

South Carolina

New Hampshire
Vermont

Maine

Massachusetts

Rhode Island

Connecticut

New York

Pennsylvania

New Jersey

District of Columbia

Delaware

Maryland

Hawaii

Alaska

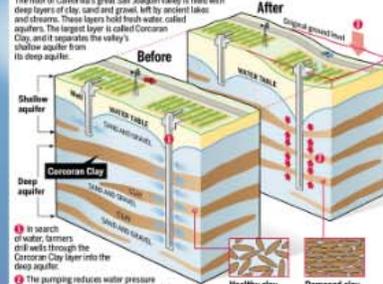
Puerto Rico

U.S. Virgin Islands

West-east division for this report

Sinking ground

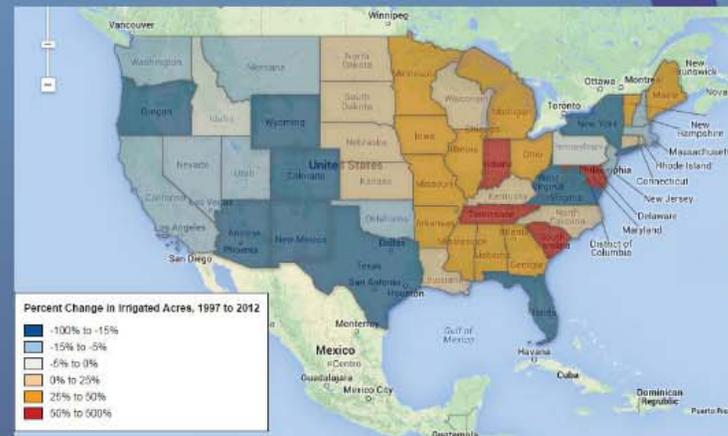
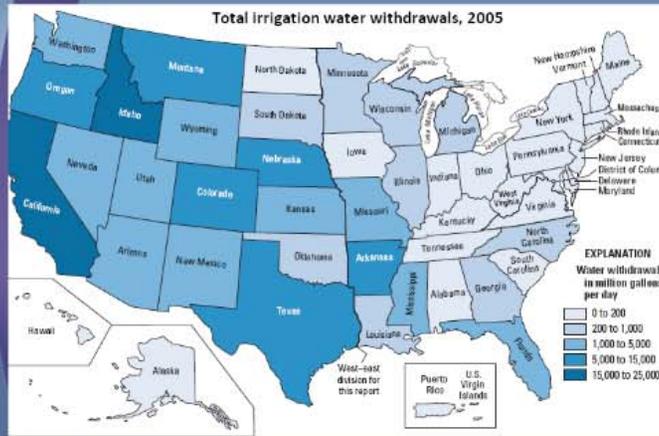
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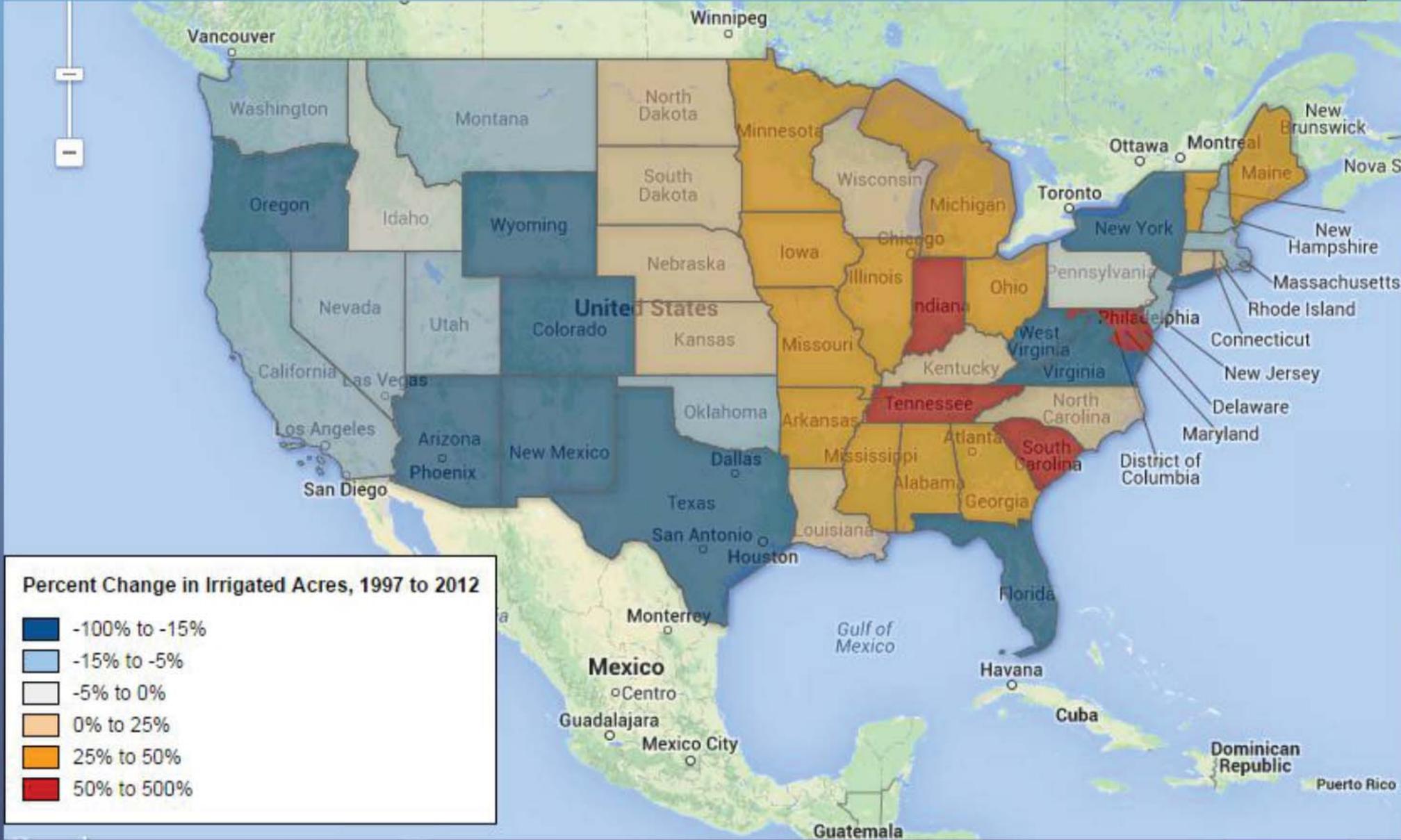


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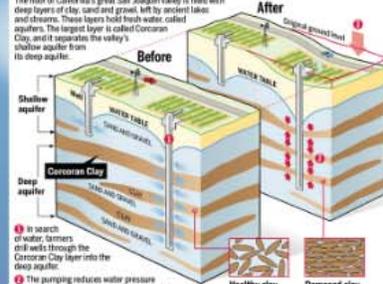
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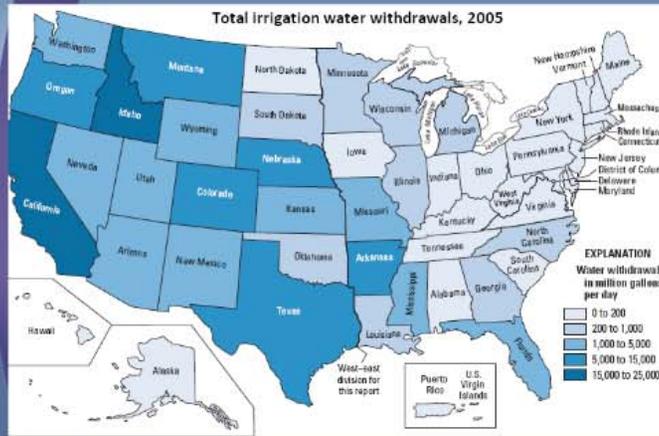
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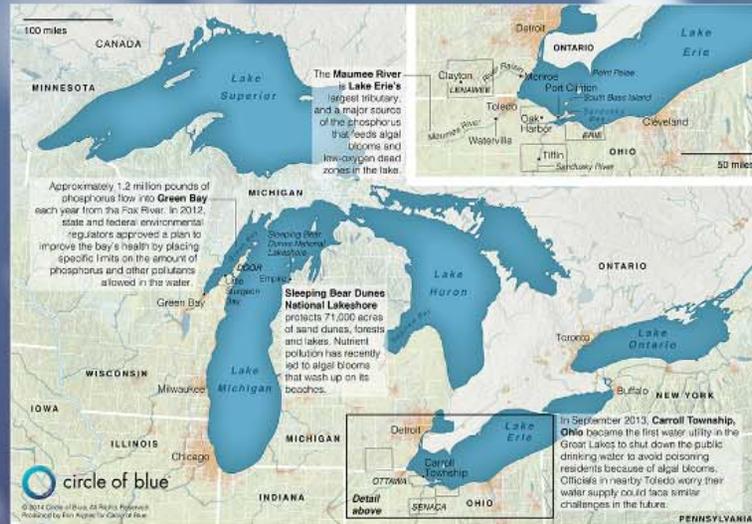
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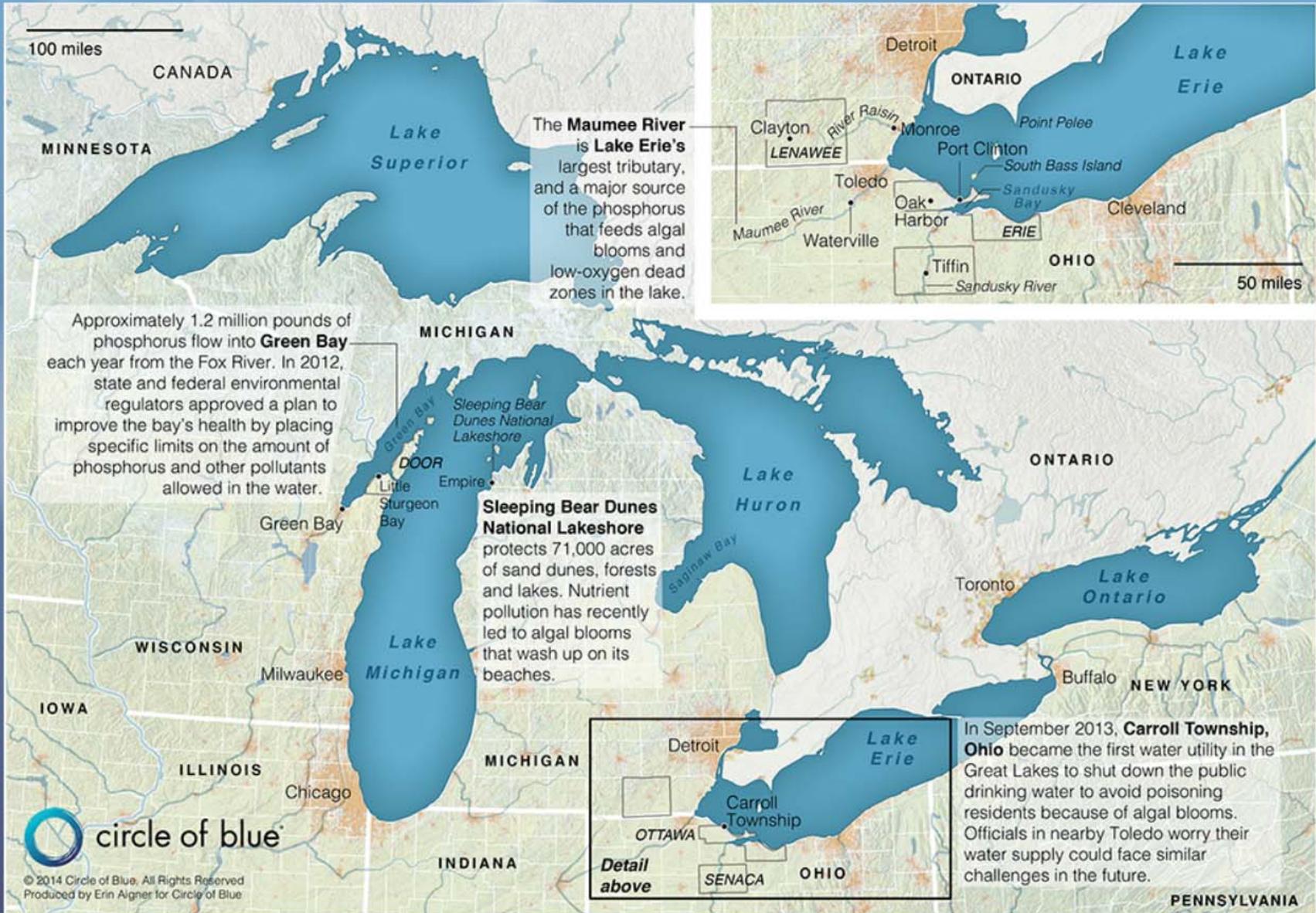
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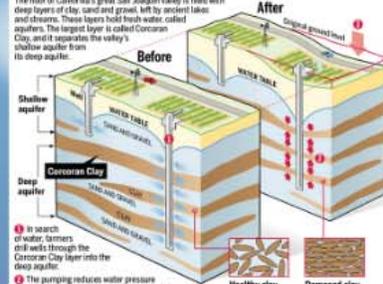






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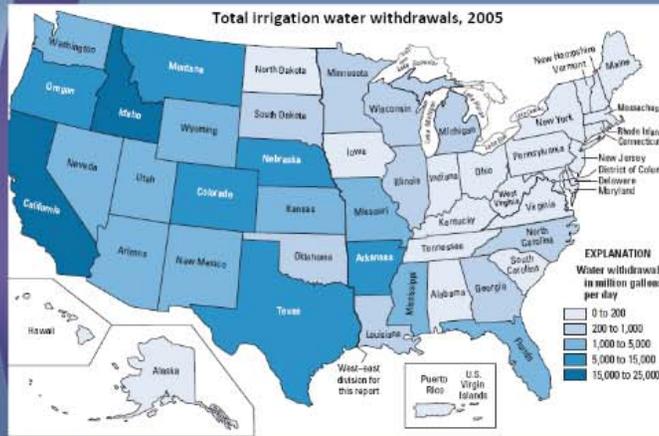
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Planning for The Future of Water

The Public Cost of Water

Enjoy Cost:Value Disparity

Wait and Watch

Wait till the full balance is due to pay the real cost



The Value of Water

Commit to Achieving World Class Water Efficiency

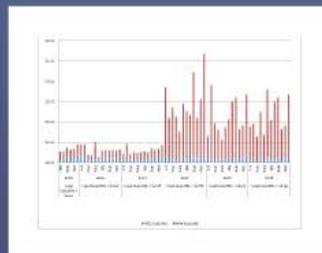
Determine an Internal Price Reflective of Value

The Public Cost of Water

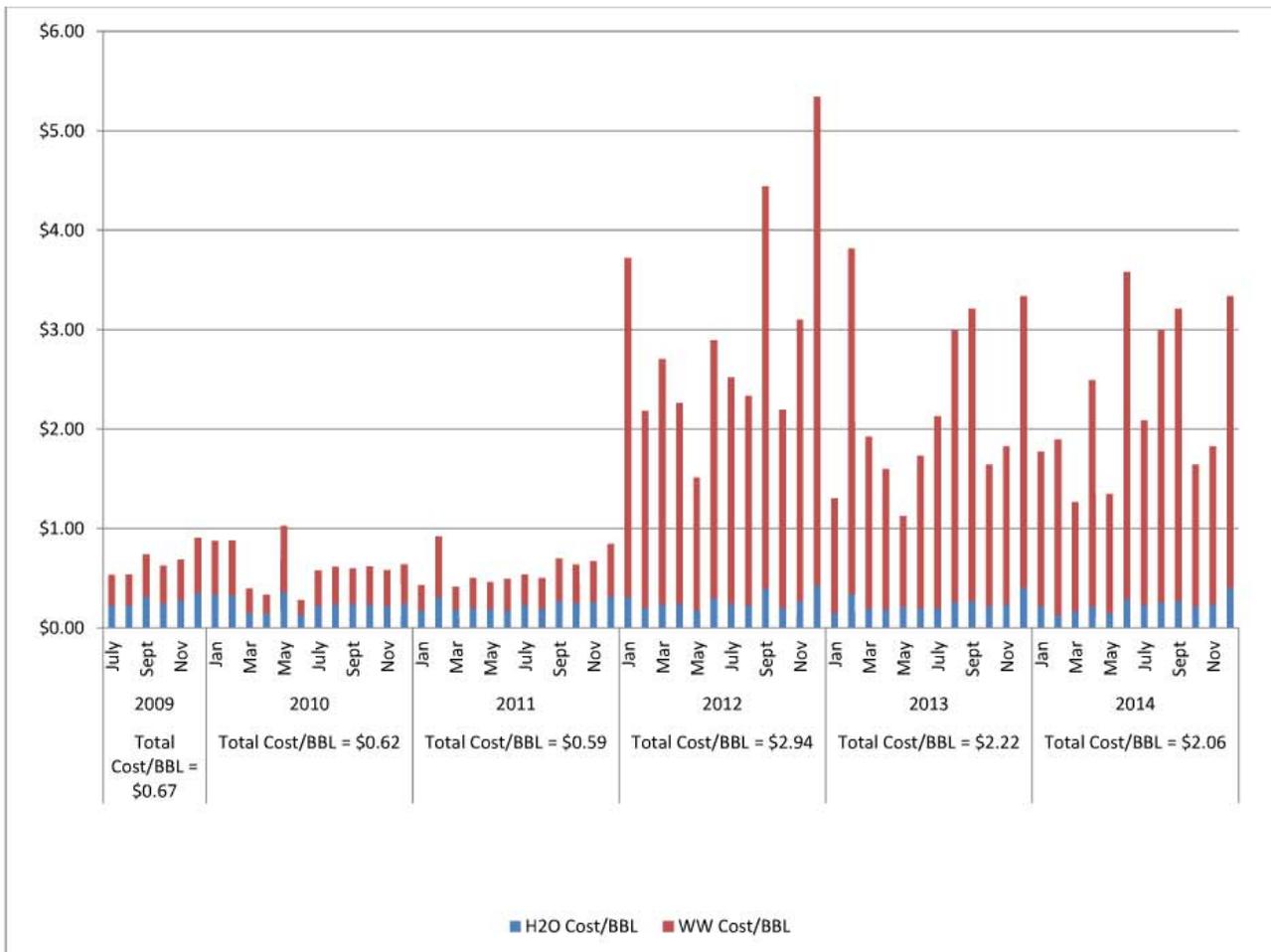
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Commit
Class



The Value of Water

**Commit to Achieving World
Class Water Efficiency**

**Determine an Internal
Price Reflective of Value**

e

Planning for The Future of Water

The Public Cost of Water

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Sustainable Water Use in Brewing

