

#5 Green Plains - Superior Ethanol Plant Energy and Water Usage vs. Cities within a 10 mile radius

Ethanol Plant without CO ₂ Capture						
No.	Ethanol Plant/ Town	Population	**Water Permit Value MGY	**2023 Water Usage MGY		Comments
Ethanol Plant - Near Superior Iowa						
	Green Plains Inc. - Superior Plant		422.0	291.2		Without CO ₂ capture water requirement
	Combined Towns All Water Usage		354.5	354.5		City residential use assumes 70 gal./person/day
1	Superior	132	3.4	3.4		Water usage too small to require a permit
2	Orleans	521	13.3	13.3		Water usage too small to require a permit
3	Arnolds Park/ Okoboji	1,878	48.0	48.0		
4	Spirt Lake	5,439	139.0	139.0		
5	Estherville	5,904	150.8	150.8		
	Percentage of ethanol plant usage of total water usage	13,874	54.35%	45.10%		
Conclusion: Without CO₂ Capture						
This ethanol plant consumes 45% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles).						

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Ethanol Plant with CO ₂ Capture						
No.	Ethanol Plant/ Town	Population	**Water Permit Value MGY	**2023 Water Usage MGY	2023 Water Usage % of Total	Comments
Ethanol Plant - Near Superior Iowa		-	-	-	-	City residential use assumes 70 gal./person/day
1	Superior	132	3.4	3.4	0.5%	Water usage too small to require a permit
2	Orleans	521	13.3	13.3	1.9%	Water usage too small to require a permit
3	Arnolds Park/ Okoboji	1878	48.0	48.0	6.8%	
4	Spirt Lake	5439	139.0	139.0	19.6%	
5	Estherville	5904	150.8	150.8	21.3%	
6	Ethanol plant water for Ethanol Production		422.0	291.2	41.1%	Without CO ₂ Capture water requirement
7	Ethanol Plant water for CO ₂ Capture		63.0	63.0	8.9%	Additional CO ₂ Capture water requirement
Total Plant and Towns		13,874	839.5	708.6	100.0%	
Percentage of ethanol plant usage of total water usage			57.8%	50.0%		
Conclusion: With CO₂ Capture						
This ethanol plant consumes 50% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles)						
*Ethanol Production Capacity of Plant - MGY		60				
Factor: Water required to cool and compress the CO₂ for capture - MGY Water/ MGY Ethanol		1.05				
Calculate additional water required for CO₂ Capture - MGY		63				
Calculate ratio of gallons of water/ gallons of Ethanol		4.9				
Total water requirement of towns and Ethanol plant - MGY		708.6				
Total water requirement of towns - MGY		354.5				
Total water requirement for ethanol plant - MGY		354.2				
Ratio of ethanol plant water use vs. surrounding area		1.00				
Percentage of ethanol plant usage of total water usage		50.0%				
Total Population within the 10 mile radius		13,874				

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Water Use					
Typical water use per person per day - Gallons/ person/ day	70				
Equivalent # of people ethanol plant water use w/o CO2 capture	11,396				
Equivalent # of people ethanol plant water use w/ CO2 capture	13,861				
Electricity Use					
Electricity to produce Ethanol - kWh/ gallon EtOH for production	0.6				
Total Electricity used to produce ethanol - kWh	36,000,000				
Electrical use to capture CO2 - kWh/ gallon EtOH	0.377				
Total Electricity used to capture CO2 - kWh	22,620,000				
Total electricity to produce ethanol and capture CO2 - kWh	5.862E+07				
Typical electrical use/ residence - kWh/year	10,476.0				
Equivalent number of residences	5,595.6				
Number of people / residence	2.4				
Equivalent number of people	13,430				
Natural Gas Use					
Natural gas use per gallon of ethanol for production - BTU's/ gal.	26,000				
Natural gas use for ethanol plant - BTU's	1.560E+12				
Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal.	0				
Typical Natural Gas use/ residence - BTU's/ year	96,000,000				
Equivalent number of residences	16,250				
Number of people / residence	2.4				
Equivalent number of people	39,000				
* Ethanol Capacity per Iowa Renewable Fuels Association		** Water usage per the greater of DNR WACOP Permit or 3 times ethanol capacity.			

#5 Green Plains Inc. Ethanol Plant (60 MGY) near Superior

Ethanol plant 2023 water usage vs. surrounding residential water usage of towns within a ten mile radius MGY (Millions of Gallons per Year).

No Permit cities:
Superior
Orleans

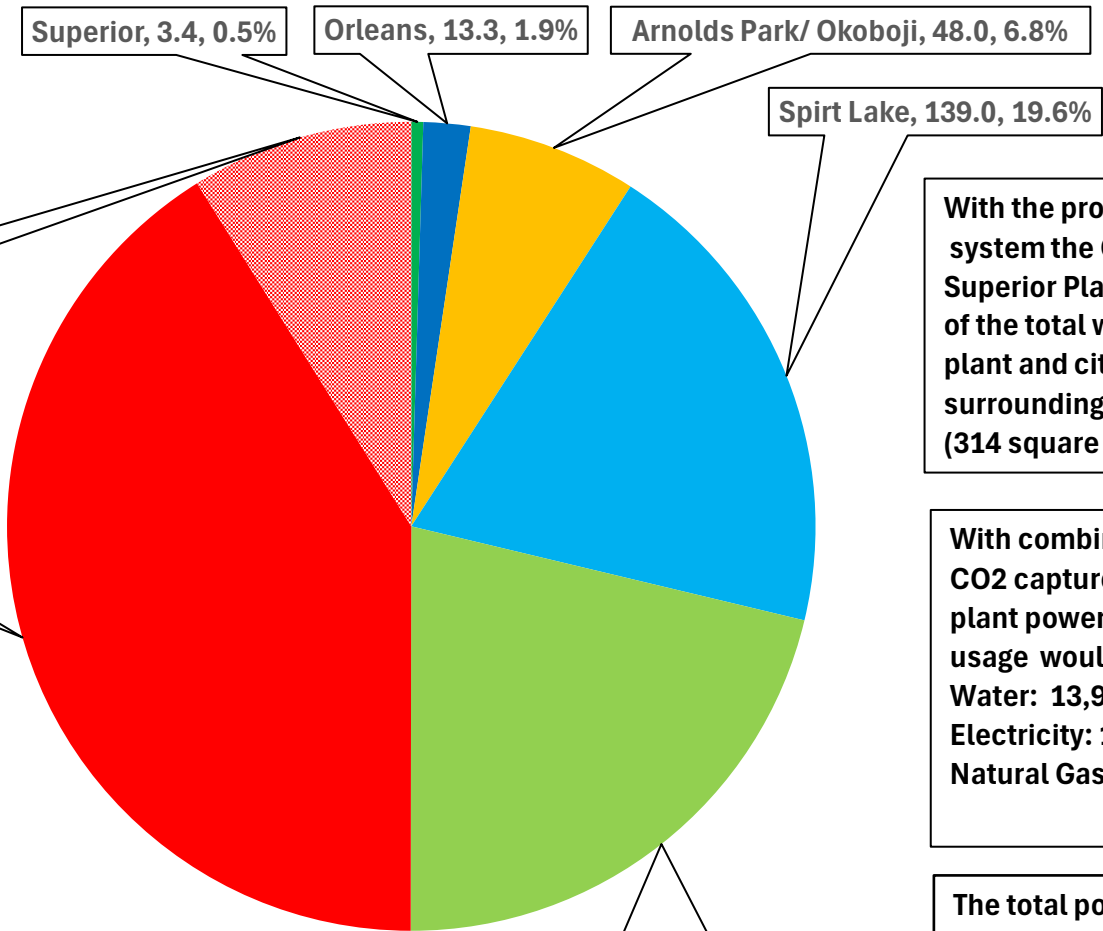
Ethanol Plant water for CO2 Capture, 63.0, 8.9%

Ethanol plant water for Ethanol Production, 291.2, 41.1%

Estherville reported 2023 water usage of 396 MGY and a population of 5,904. This is 184 gal. per person/day - about 2.5 times the typical residential water usage of 70 gal./ day.

4.9 gallons of water per gallon of ethanol is used for production. An additional 1.05 is required for CO2 capture.

The plant draws it's water from the Cretaceous Aquifer
Water levels in this area are down as much as 30 feet since 2015



With the proposed CO₂ capture system the Green Plains Inc. Superior Plant will use 50% of the total water used by the plant and cities within the surrounding 10 mile radius. (314 square miles)

With combined production and CO2 capture the ethanol plant power and 2023 water usage would be equivalent to:
Water: 13,900 people.
Electricity: 13,400 People.
Natural Gas: 39,000 People

The total population of the cities within the 10 mile radius is 13,874.

This plant will use as much water as all the cities within a 10 mile radius of the plant.