
Little Mountain Brewers
GREAT PEOPLE BREWING GREAT BEER

March Meeting

- Club Stuff
  - Financial report –Steve?

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Calendar

- Future meetings
  - SMASH beer tasting - April 28th
- Big Brew Day – May 3rd @ Eleventhree

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Club Outings

- Club outing
  - Schnitz Ale Strongsville was great. Thanks Donna!
- Other ideas
  - Twin Oast brewery – May 31-June1?
  - Royal Docks
  - Cleveland Hts. crawl – Boss Dog tour, Vodoo Brewing, Bottle House

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Upcoming Events

- Brewly Olympics – Carribbean
- TRASH Competition – April 25 &26 in Pittsburg
- Big Brew Day – May 3 @ Eleventhree
  - Big Blimp Barleywine
  - Other Recipes – Double Extra Hazy IPA, Beliner Weisse, Lambic, Tree House Julius
- Kent craft brew fest – May 17
- Iron Brewer

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Hop Fest Recipe

- Brew same base recipe and ferment with different hops
- Recipe
  - Pale Ale, 1.042 O.G., 20 IBU, carbonate to 2.3 volume.
    - For 5 gallon batch
      - 12# 2 Row pale malt mashed at 150 for 60 minutes
      - 7.5 AAU first wort
      - 7.5 AAU 10 minutes
      - 7.5 AAU 5 minutes
      - 1 oz. 0 minutes
      - Dry hop 1.5 oz
    - For 1 gallon batch
      - 2# 7oz 2 Row pale malt mashed at 150 for 60 minutes or1.35# Light DME or 1.6# LME
      - 1.5 AAU first wort
      - 1.5 AAU 10 minutes
      - 1.5 AAU 5 minutes
      - .5 oz. 0 minutes
      - Dry hop .5 oz
    - Yeast – US-05 @ 67 or WLP001, WLP060, WLP090, Wyeast 1056

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Water

- Hard vs. soft vs. RO
  - Based on amount of calcium, magnesium and bicarbonate in the water
  - Soft = 0-50 ppm, medium hard 51-110, hard 111-200, very hard >200
  - Bicarbonates cause temporary hardness. You can make them precipitate out by boiling. Greater than 100 ppm causes harsh taste and alkalinity = higher pH in mash
  - Reverse Osmosis (RO) – strips out most but not all minerals – some carbonates may remain
- Alkalinity – measure of the ability to buffer or resist pH changes. Mostly caused by bicarbonates
- Residual Alkalinity – Remaining alkalinity after calcium and magnesium (permanent hardness) react with phosphates in malt.
- pH - measure of excess free H ions in the water
  - Strong acid = ph 0
  - Strong base = pH 14 or alkaline
  - For mashing, enzymes that covert start to sugar work best at a pH of 5.2 to 5.6.
  - Mash pH carries over to kettle. Kettle pH affects how the flavor are perceived on the palate.
- Other minerals - impact flavor, body, yeast health

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A quick note on Chlorine

- City water contains chlorine or cloramines for sterilization
- These will lead to harsh or medicinal flavors
- Use a carbon filter or Campden tablets

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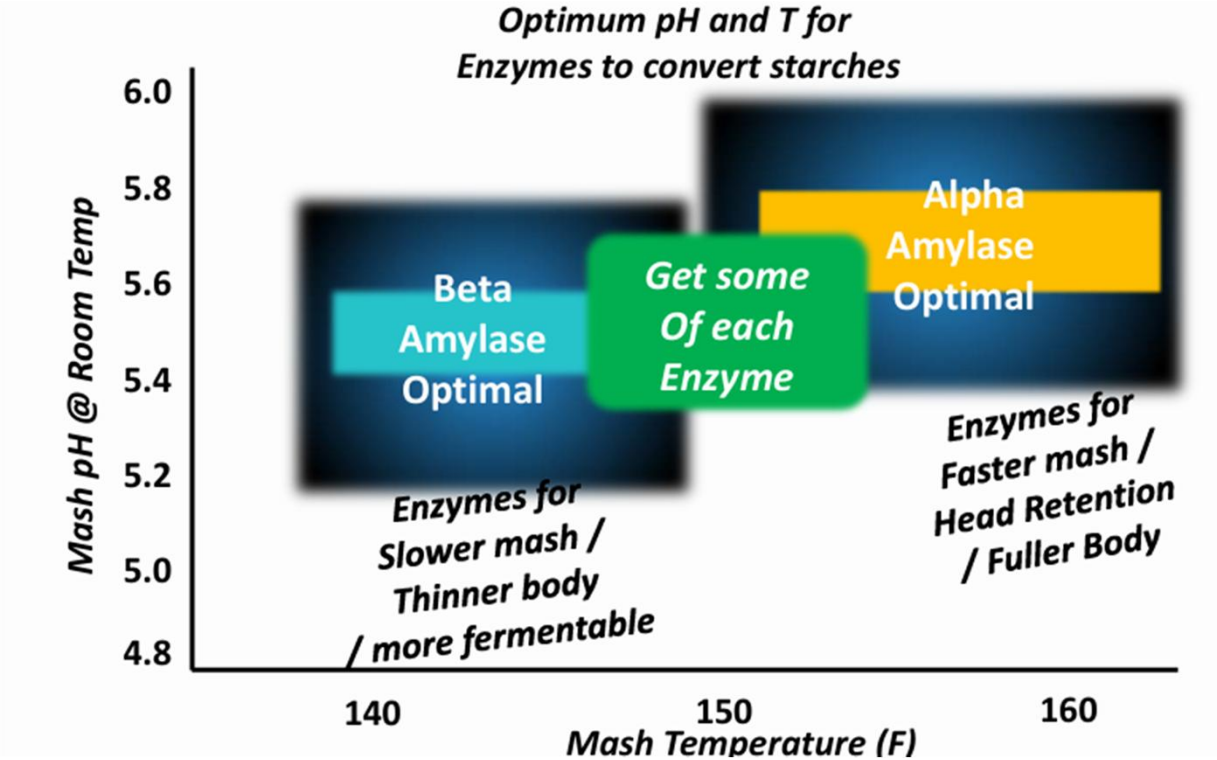
pH, Temp and Mashing



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Important minerals in water

- Calcium – most important mineral - 50-150 ppm
  - Reacts with phosphates in barley to adicdify mash. Helps enzymes responsible for converting starches
  - Reduces tannin and husk flavors, improves clarity and stability
  - Too much will cause a harsh flavor and will reduce hop utilization
- Bicarbonate - 0-250 ppm (temporary hardness) will counteract calcium.Resist pH changes due to acids in dark malts.
- Sulfate – 50-250 ppm accentuates dryness and bitterness from hops. Does not play well with noble hops
- Chloride – 0-250 ppm accentuates fullness and sweetness, think malty
- Magnesium – 10-40 ppm accentuates flavor and sourness. Good for yeast health
- Sodium – 0-150 ppm accentuates flavor but can be harsh, salty or sour at higher concentrations

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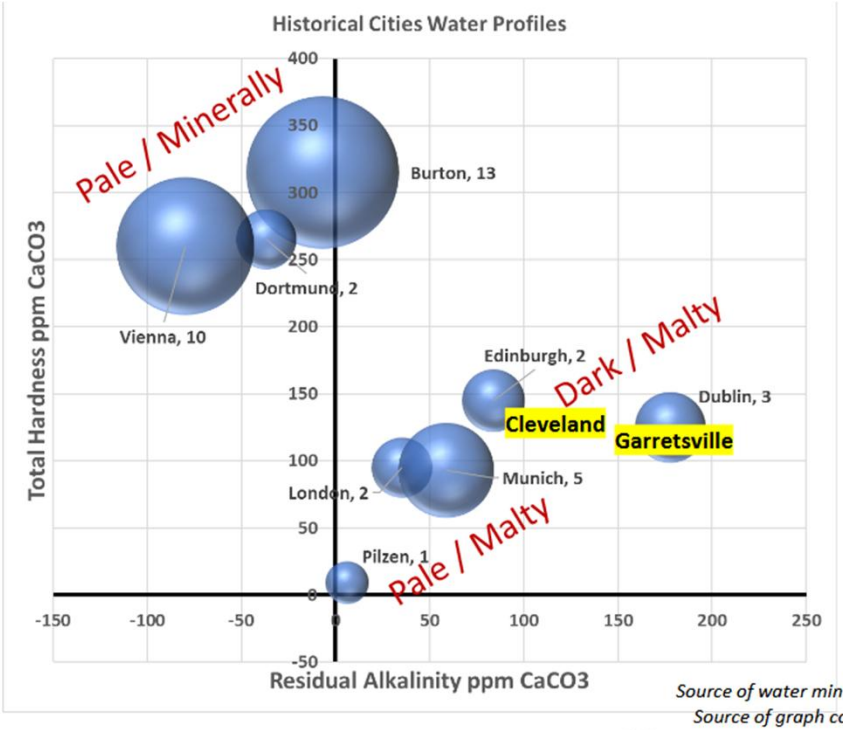
Mineral content of some target cities

Mineral	Ca^{2+}	Mg^{2+}	HCO_3^-	Sulfate	Chloride	Sodium
Burton	**275**	**40**	**260**	**450**	**35**	**25**
Dortmund	**225**	**40**	**180**	**120**	**60**	**60**
Dublin	**120**	**5**	**325**	**55**	**20**	**12**
Edinburgh	**120**	**25**	**225**	**140**	**65**	**55**
London	**90**	**5**	**125**	**40**	**20**	**15**
Munich	**75**	**18**	**150**	**10**	**2**	**2**
Pilzen	**7**	**2**	**15**	**5**	**5**	**2**
Vienna	**200**	**60**	**120**	**125**	**12**	**8**

	RA	Hardness	SO4/Cl
Dublin	178	125	3
Edinburgh	84	145	2
Munich	59	93	5
London	35	95	2
Pilzen	6	9	1
Burton	-7	315	13
Dortmund	-37	265	2
Vienna	-80	260	10

RA = Alkalinity – Ca/1.4 – Mg/1.7 (ppm)
= (HCO3/1.22) – Ca/1.4 – Mg/1.7 (ppm)

Hardness = Ca + Mg (ppm)



Source of water minerals : Palmer
Source of graph concept : Amey

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Some historical water profiles

- **Burton-on-Trent (England):**
  - Known for its high sulfate content, Burton water is associated with a dry, crisp, and hoppy flavor profile, particularly in pale ales and IPAs.
- **Pilsen (Czech Republic):**
  - The water in Pilsen is characterized by very low mineral content, which contributes to the light, crisp, and clean character of Pilsner beer styles.
- **Dublin (Ireland):**
  - Dublin's water profile, with its high carbonate content, is linked to the development of dry, robust stouts.
- **Munich (Germany):**
  - Munich water is known for its higher alkalinity, which can lead to a more malty flavor profile, often associated with dark lagers like Munich Dunkel.
- **Dortmund (Germany):**
  - Dortmund's water, with its higher chloride levels, is often linked to the assertive malt character of Dortmund Export lagers.
- **London (England):**
  - London's water profile, with its higher alkalinity, has historically been associated with the development of dark ales like Porters, where the higher alkalinity is balanced by the use of toasted and dark malts.
- **Vienna (Austria):**
  - Vienna's water profile is similar to Dortmund's, but with slightly less calcium, sodium, and chloride, which can contribute to a more balanced flavor profile.

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How SRM is related to Residual Alkalinity

- Lighter beers will have less acidic malts and so need a lower RA
- Darker beers will need a higher RA to buffer the pH from getting to low due to the acids in the dark malt

Color	RA	Style
Straw	-60-0	Blonde, Am Wheat, Ord/Best bitter, Lt Am, Std Am, Helles, All Pils
Pale	-30-0	Blonde, Weizen, Wits, Cream, Kolsch Dortmunder, Bel Blonde, Golden Str, Tripel
	-30-30	Saison, APA, Am IPA, 2x IPA
Amber	0-60	Saison, Alt, Cal Com, ESB, Irish, Am Amber, Eng IPA, Roggen, Bel Pale, Mild, Scottish ales, Ord/Best bitter, Scotch, Biere de Garde, Dubbel, Old, Barleywines
Brown	30-90	Eng Brown, Brwn Porter, Dry Stout
Dark	60-120	Eng Brown, Brwn Porter, All Stouts, Dunkelweizen, ABA
	120-200	Baltic, Stronger stouts, Weizenbock, Dark Strg, Old Ale

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Sulfates and Chloride

- Ratio of sulfate (gypsum) to chloride effects flavor profile

Bitterness	Sulfate to Chloride Ratio	Style
Very Bitter	**10 - 2**	Hoppy beers, DIPA, IPA
Mod Bitter	**2 - 1.3**	Pale Ales
Balanced	**1.3 – 0.8**	Belgians, Wheats
Malty	**0.8 – 0.7**	Browns, Porters
Very Malty	**0.7 – 0.5**	Stouts

Source : Adapted from Palmer, NAHC 2014 presentation.

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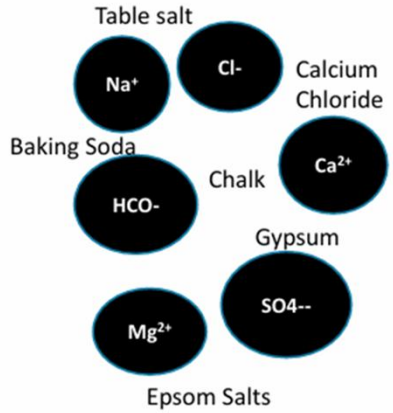
Water Profiles Lager Styles (Table 18 Palmer/Kaminski)

Type(Ta	Color	Bitterness	Ca	Alkalinity	Sulfate	Chloride	Kolbach RA	Acidify	Styles
Light lager	Pale	Soft	50	0-40	0-50	50-100	-60-0	Yes	Lite American lager, Standard American Lager, Munich Helles, Bohemian Pils
Medium Lager	Pale	Moderate (Assertive)	50-75 (75-150)	0-40 (40-80)	50-150	50-100	-60-0 (-30-30)	Yes	American Premium Lager, German Pils, Classic American Pils, (Dortmunder Export)
Medium Lager	Amber	Soft, moderate	50-75	40-120	0-100	50-150	0-60	Maybe	Vienna, Oktoberfest
Medium Lager	Brown/Black	Soft, moderate	50-75	80-120	0-50	50-150	40-80	No	American Dark, Munich Dunkel, Schwarzbier
Strong Lager	Amber	Soft, moderate	50-75	40-80	0-100	50-150	0-60	Maybe	Helles/Maibock, Traditional Bock, Doppelbock
Strong Lager	Brown/Black	Soft, moderate	50-100	80-150	0-100	50-100	60-120	No	Traditional Bock, Doppelbock, Eisbock, Baltic Porter

Water Profiles Ale Styles (Table 19 Palmer/Kaminski)

Type	Color	Bitterness	Ca	Alkalinity	Sulfate	Chloride	Kolbach RA	Acidify	Styles
Light Ale	Pale	Moderate	50-100	0-80	100-200	50-100	-60-0	Yes	Blonde Ale, American Wheat, Standard Bitter, Best Bitter
Light Ale	Amber	Soft, Moderate	50-150	40-120	100-200	50-100	0-60	Maybe	English Mild, Scottish 60/70/80, Standard Bitter, Best Bitter
Light Ale	Brown/Black	Moderate	50-75	80-150	50-150	50-100	30-90	Maybe	English Brown, Brown Porter, Dry Stout
Medium Ale	Pale	Soft, Moderate	50-100	0-80	0-50	0-100	-30-0	Yes	Weizen, Witbier, Cream Ale, Blonde Ale, Kolsch
Medium Ale	Pale	Moderate (Assertive)	50-150	40-120	100-400	0-100	-30-30	Maybe	American Pale Ale, American XPA, Saison, American IPA, Double IPA
Medium Ale	Amber	Moderate (Assertive)	50-150	40-120	100-300	50-100	0-60	No	Altbier, California Common, ESB, Irish Red, American Amber, English IPA, Roggenbier, Belgian Pale, Saison
Medium Ale	Brown/Black	Moderate (Assertive)	50-75	80-160	50-150	50-150	60-120	No	American Brown, English Brown, Brown Porter, Robust Porter, Dry Stout, Sweet Stout, Oatmeal Stout, Foreign Extra Stout, American Stout, Dunkelweizen
Strong Ale	Pale	Moderate	50-100	0-40	50-100	50-100	-30-0	Maybe	Belgian Blonde, Golden Strong, Tripel
Strong Ale	Amber	Moderate (Assertive)	50-100	40-120	50-100	50-150	0-60	No	Strong Scotch Ale, Biere de Garde, Dubbel, Old Ale, Barleywine
Strong Ale	Brown/Black	Moderate (Assertive)	50-75	120-200	50-150	50-150	120-200	No	Baltic Porter, Foreign Extra Stout, American Stout, Russian Imperial Stout, Weizenbock, Belgian Dark Strong, Ole Ale

How do you change your water profile?



Consider your base water

Use Gypsum (Calcium Sulfate)
Use Calcium Chloride
Use Epsom Salts (Mg Sulfate)
Use Baking Soda (Na bicarbonate)
Use Table Salt (sodium chloride)

Use combinations of these ions to achieve the water profile you want

Use ions to affect pH or RA
Use ions to refine flavor

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Saison iS

Water Profile (Parts Per Million)

					Ions	Ca	Mg	Na	SO4	Cl	HCO3
					Recommended Range	(50-150)	(10-40)	(0-150)	(50-250)	(0-250)	(0-250)
Base Profile	7.99	gal	Name	121024 Saison Water OOS		3.0	3.0	3.0	3.0	3.0	3.0
				Gypsum (CaSO4)	3.1 g	24.0			57.6		
				Table Salt (NaCl)	0.1 g			1.5		2.4	
				Epsom Salt (MgSO4)	3.0 g		9.8		38.7		
				Calcium Chloride (CaCl)	2.7 g	24.7				43.6	
				Baking Soda (NaHCO3)	0.0 g			0.0			0.0
	☒ Exclude Chalk			Chalk (CaCO3)	0.0 g	0.0					0.0
Dilute With	0.00	gal	Name	121024 Saison Water OOS		0.0	0.0	0.0	0.0	0.0	0.0
					Totals	51.7	12.8	4.5	99.3	49.0	3.0
Target Profile			Name	121024 Saison Water OOS		50.0	10.0	3.0	100.0	50.0	3.0
					Difference	1.7	2.8	1.5	-0.7	-1.0	0.0

Ca^{2+} 50-150
SO_4 100-200
Cl 50-100
Kolbach RA 0-60
Total ALK 40-120

Match Target Profile | Clear | Save Totals As... | Save Additions to Target

Analysis of 'Total' Water Profile Line

Alkalinity	2 ppm	Residual Alkalinity	-42 ppm	Sulfate/Chloride Ratio	2.0
Effective Hardness	44 ppm	Color Range	2-7 SRM	Sulfate/Chloride Balance	Bitter

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Saison - Max

Water Profile (Parts Per Million)

				Ions	Ca	Mg	Na	SO4	Cl	HCO3
				Recommended Range	(50-150)	(10-40)	(0-150)	(50-250)	(0-250)	(0-250)
Base Profile	7.99	gal	Name	121024 Saison Water OOS Max	3.0	3.0	3.0	3.0	3.0	3.0
			Gypsum (CaSO4)	13.1 g	100.8			241.5		
			Table Salt (NaCl)	0.3 g			3.6		5.7	
			Epsom Salt (MgSO4)	4.2 g		13.6		53.8		
			Calcium Chloride (CaCl)	5.6 g	50.3				89.0	
			Baking Soda (NaHCO3)	0.0 g			0.0			0.0
	☒ Exclude Chalk		Chalk (CaCO3)	0.0 g	0.0					0.0
Dilute With	0.00	gal	Name	121024 Saison Water OOS Max	0.0	0.0	0.0	0.0	0.0	0.0
				Totals	154.0	16.6	6.6	298.3	97.7	3.0
Target Profile			Name	121024 Saison Water OOS Max	150.0	10.0	3.0	300.0	100.0	3.0
				Difference	4.0	6.6	3.6	-1.7	-2.3	0.0

Match Target Profile | Clear | Save Totals As... | Save Additions to Target

Ca^{2+} 50-150
SO_4 100-200
Cl 50-100
Kolbach RA 0-60
Total ALK 40-120

Analysis of 'Total' Water Profile Line

Alkalinity	2 ppm	Residual Alkalinity	-117 ppm	Sulfate/Chloride Ratio	3.1
Effective Hardness	120 ppm	Color Range	0-0 SRM	Sulfate/Chloride Balance	Bitter

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Saison - iS

Water Profile (Parts Per Million)

				Ions	Ca	Mg	Na	SO4	Cl	HCO3
				Recommended Range	(50-150)	(10-40)	(0-150)	(50-250)	(0-250)	(0-250)
Base Profile	7.99 gal	Name	121024 Saison Water iS		3.0	3.0	3.0	3.0	3.0	3.0
			Gypsum (CaSO4)	3.0 g	23.1			55.4		
			Table Salt (NaCl)	0.0 g			0.0		0.0	
			Epsom Salt (MgSO4)	3.2 g		10.3		40.8		
			Calcium Chloride (CaCl)	2.9 g	25.9				45.9	
			Baking Soda (NaHCO3)	3.6 g			32.1			84.8
	☒ Exclude Chalk		Chalk (CaCO3)	0.0 g	0.0					0.0
Dilute With	0.00 gal	Name	121024 Saison Water iS		0.0	0.0	0.0	0.0	0.0	0.0
				Totals	52.0	13.3	35.1	99.2	48.9	87.8
Target Profile		Name	121024 Saison Water iS		50.0	10.0	3.0	100.0	50.0	100.0
				Difference	2.0	3.3	32.1	-0.8	-1.1	-12.2

Ca^{2+} 50-150
SO_4 100-200
Cl 50-100
Kolbach RA 0-60
Total ALK 40-120

Match Target Profile | Clear | Save Totals As... | Save Additions to Target

Analysis of 'Total' Water Profile Line

Alkalinity	72 ppm	Residual Alkalinity	27 ppm	Sulfate/Chloride Ratio	2.0
Effective Hardness	45 ppm	Color Range	7-12 SRM	Sulfate/Chloride Balance	Bitter

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Building standard profiles with RO water

- Courtesy of Steve Amey
- Start with RO water
- Check pH of mash and add a drop or 2 of Lactic acid if the pH is > 5.6
- SRM 2-7 beers (Straw; BASE WATER) – 1 tsp Calcium Chloride + 1 tsp Gypsum (RA: -40, Likely need to add (drops) Lactic Acid to mash to hit pH)
- SRM 5-10 beers (Pale beers) – BASE WATER + ½ tsp Baking Soda (BS) (RA: -1; prorate BS to mash volume and add 1-2 drops Lactic acid to sparge)
- SRM 12-16 beers (Amber beers) – BASE WATER + 1 ½ tsp Baking Soda (RA: +80; prorate BS to mash volume or add 1-2 drops Lactic acid to sparge)
- SRM 20-25 beers (Dark beers) – BASE WATER + 2 ¾ tsp Baking Soda (RA: +175; prorate BS to mash volume or add 1-2 drops Lactic acid to sparge)

Assumes 5 gallon batch. With 8.7 G total water. Base water : 56ppm Calcium, 40 ppm hardness, Sulfate/Chloride : 1.4 “balanced;”
Adjust Sulfate or Chloride by up to 1 tsp to emphasize effect you want.

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And Finally

- What's in your fermenter?
- Beer taste

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