NHC – Cincinnati 2008

Residual Alkalinity - The Secret to Brewing the Best Beer

Or "How to Use that #$%^*&@! Spreadsheet"

John Palmer

Getting Started:

- *Open your books and turn to Chapter 15.*
- *How many people have added salts to brewing water?*
- *How many people have heard of RA?*
- *How many people think they have a working understanding of RA?*
- *How many people have used my nomograph or spreadsheet?*

Opening Remarks

- ***Beer pH is like tuning the radio dial - you need to find the point where you get the most fidelity/flavor.***
- ***Beer pH depends on the mash pH and the fermentation.***
- ***The mash pH depends on the water chemistry and the grainbill.***
- ***Residual Alkalinity is the key to predicting the mash pH.***

Opening Remarks con't

- *There are rules, which are meant to enforce the guidelines, which are derived from the principles, that suffice until you really understand what you are doing....*
- *Brewing Software are just Tools - tools that help your brewing. (chainsaw)*
- *We cannot reliably calculate the mash pH, but we can reliably estimate it.*
- *Palmer's Mash RA Spreadsheet is a tool.*

Why Water Matters:

- *The water and the malts drive the mash chemistry and the enzyme activity.*
- *Adding Brewing Salts Always Affects Flavor and pH.*
- *Calcium, Magnesium, and Carbonate affect pH.*
- *Sulfates accentuate hop bitterness, making it more crisp.*
- *Sodium and Chloride accentuate the malt flavors.*

What is Hard Water?

- *Hard water contains high amounts of Calcium and Magnesium. (et. al.)*
- *Hard water pH can range from 5-10.*
  - *Acidic (<7) or Alkaline (>7)*
  - *pH depends on the balance of hardness to alkalinity.*
- *Hard water is* GOOD *for brewing because calcium is an* ***important co-factor*** *for many brewing bio-chemical reactions.*

What is Soft Water?

- ***Soft water does not contain high levels of calcium, magnesium, or other cations.***
- ***Soft water pH can range from 7-10.***
- ***Soft water can be alkaline, but alkaline water is not necessarily soft.***

What does Water Softening Do?

- *Salt-based Water Softeners exchange sodium ions for calcium, magnesium, iron, etc.*
  - *Can be helpful if set correctly.*
  - *But often throwing the baby out with the bath water.*
- *Water Softeners do not affect the alkalinity.*
  - *The result is extra-alkaline water.*

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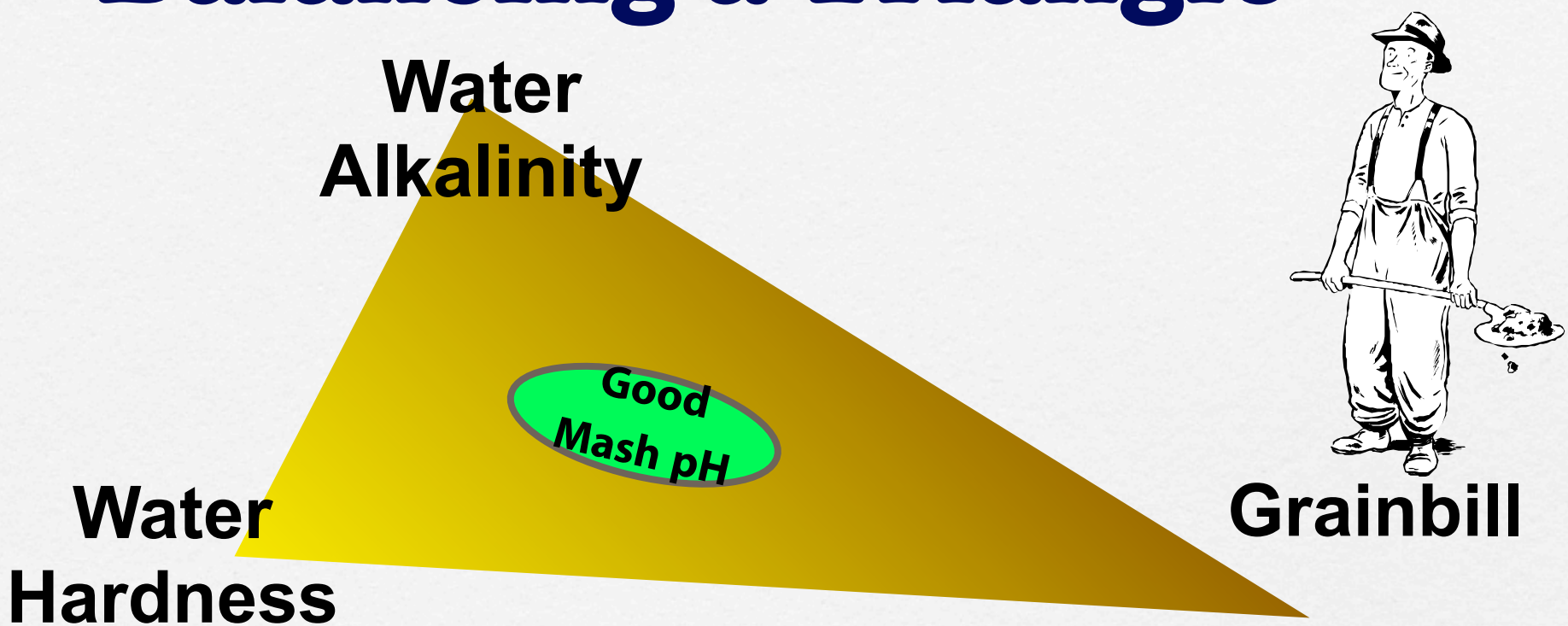
Review of pH

- *The target mash pH range for EVERY beer, regardless of style, is: 5.4-5.8 @ room temperature.*
- *pH papers are made to be used on room temperature samples.*
- *pH meters with ATC adjust the measured pH of the sample to the calibration temperature.*
- *Calibration solutions are most accurate at room temperature.*

Balancing a Triangle



- ***Hardness, Alkalinity, and Grainbill acidity balance to determine your mash pH.***

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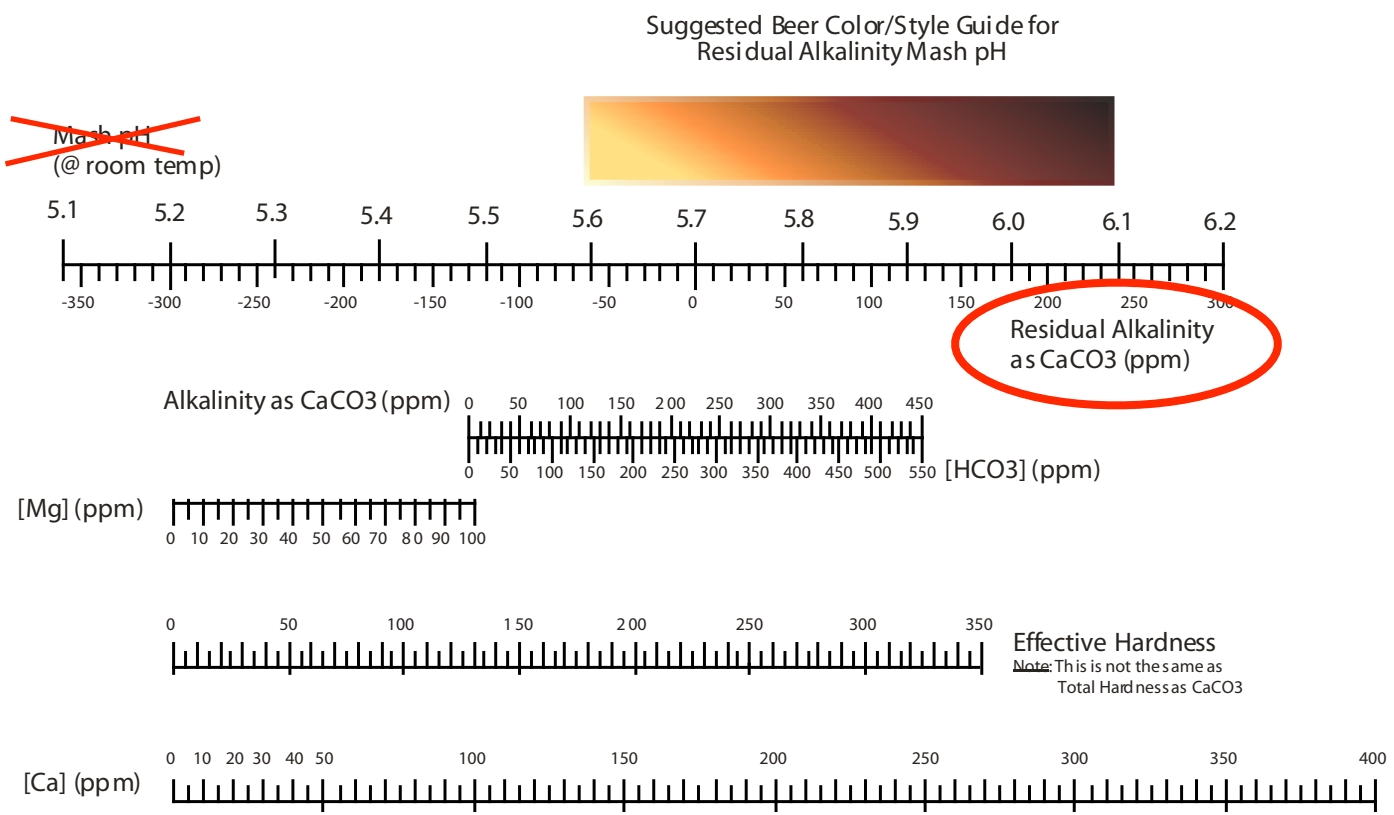
- *Low RA means you should brew light beers.*

RA and Classic Brewing Waters

- *Most water reports are the individual annual averages for a particular mineral.*
- *As listed, all the minerals do not add up to a "real" water. A real water should have all the ion charges sum to zero.*
- *Don't get stuck on trying to match a particular water.*
- *MATCH the RA to the COLOR of the BEER STYLE first, then worry about the others.*

Residual Alkalinity Nomograph



Usage Notes:
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2. The actual pH of the mash at mash temperature (~150°F) is typically .35 pH less than it measures at room temperature.

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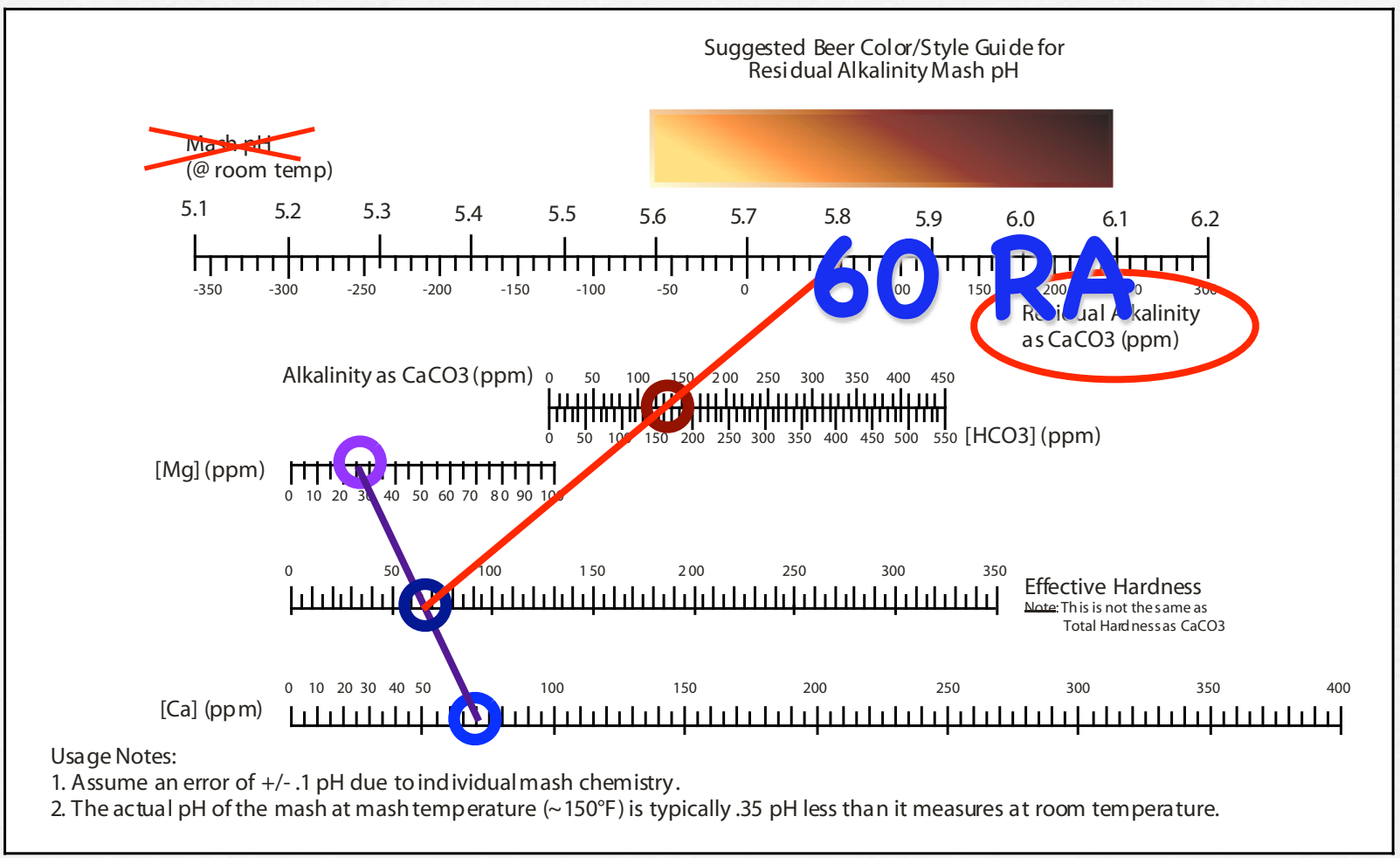

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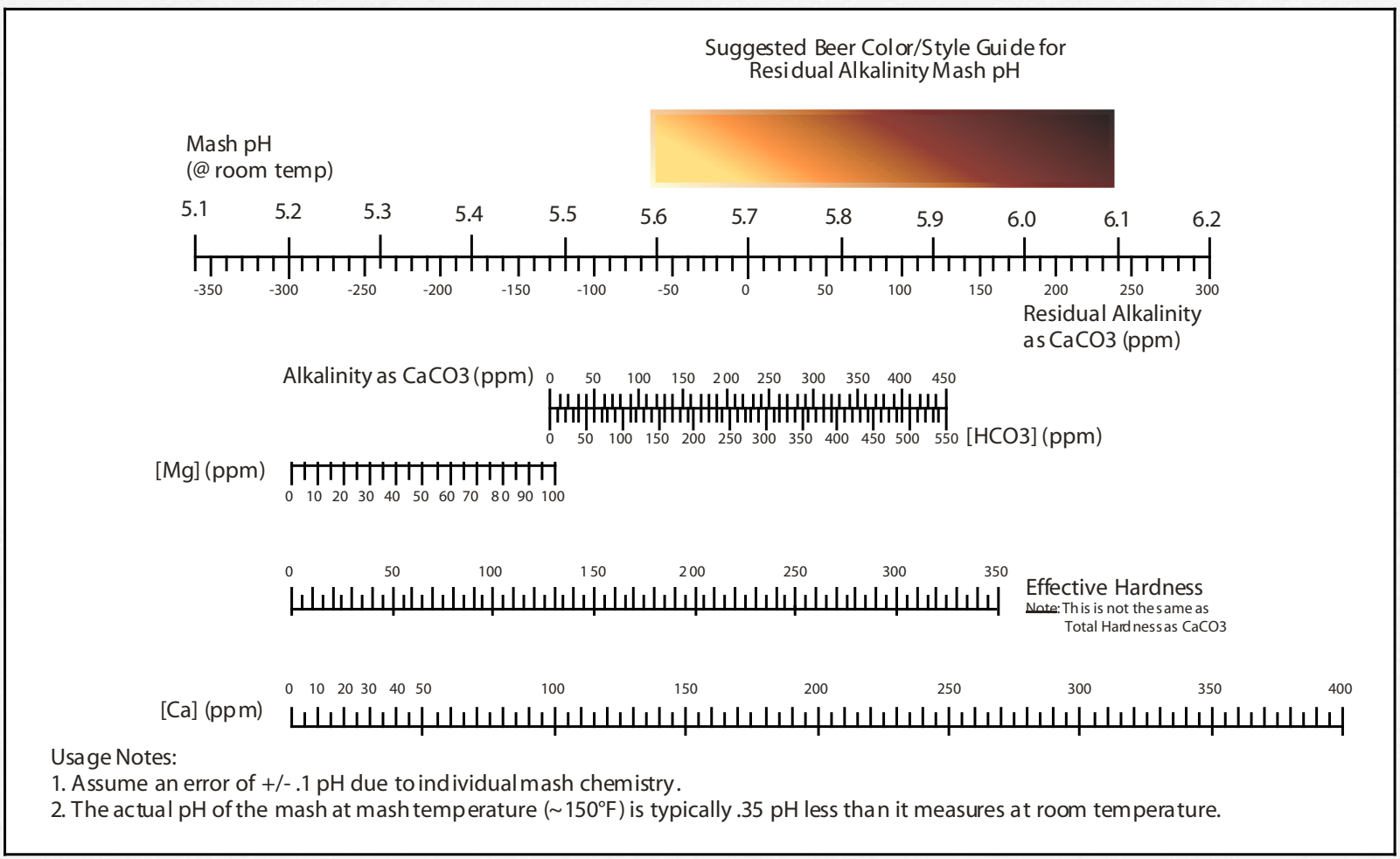

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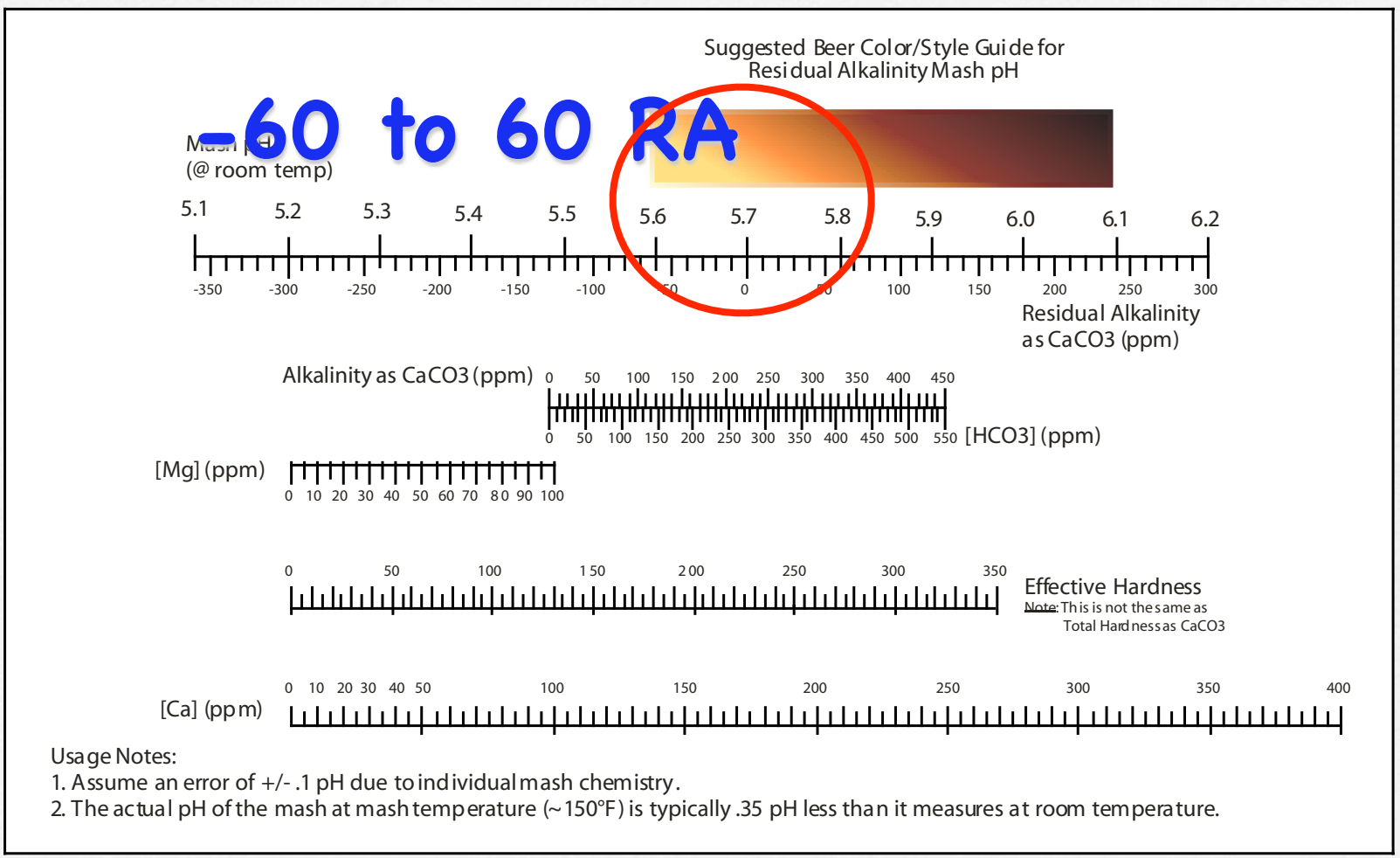

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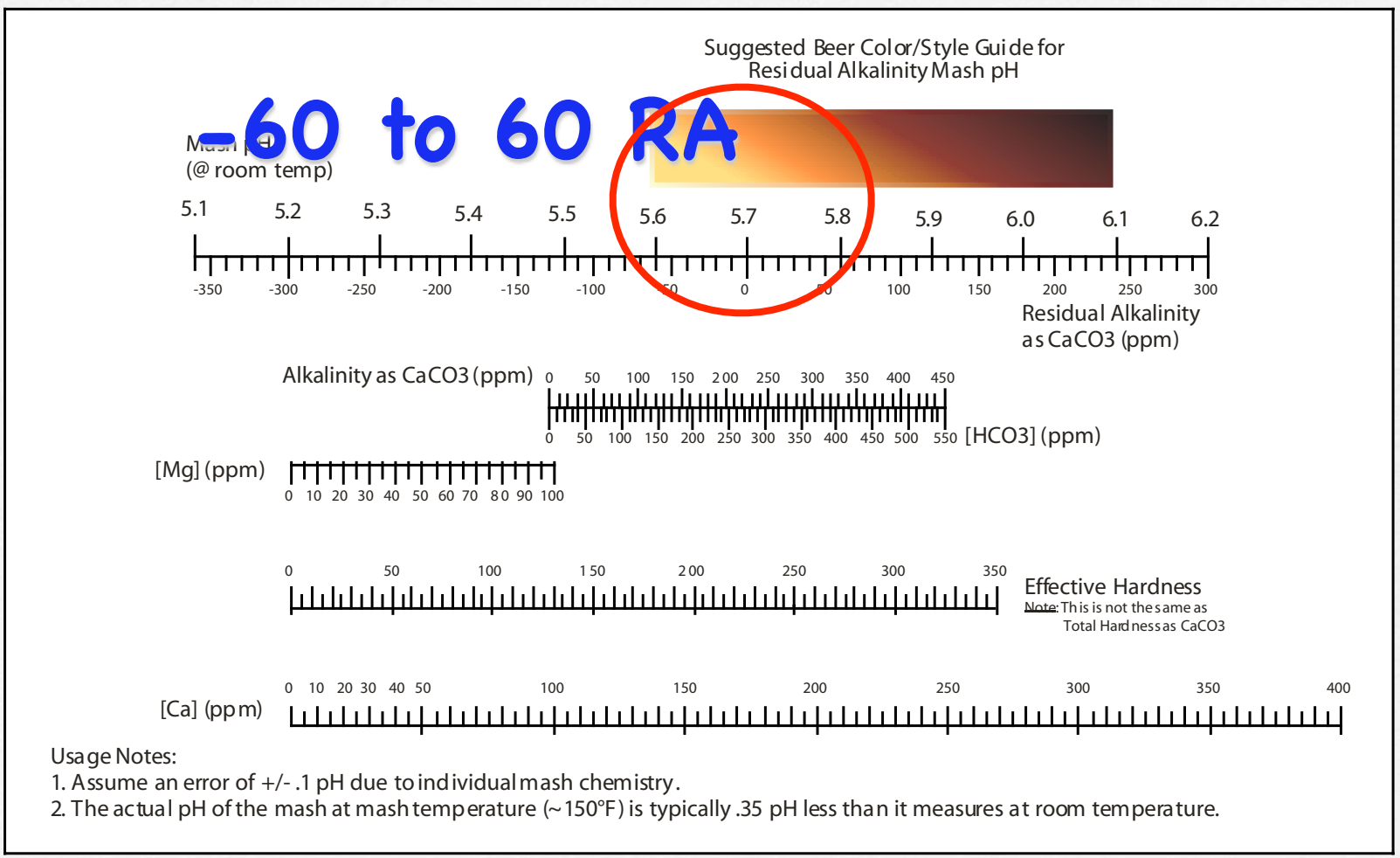

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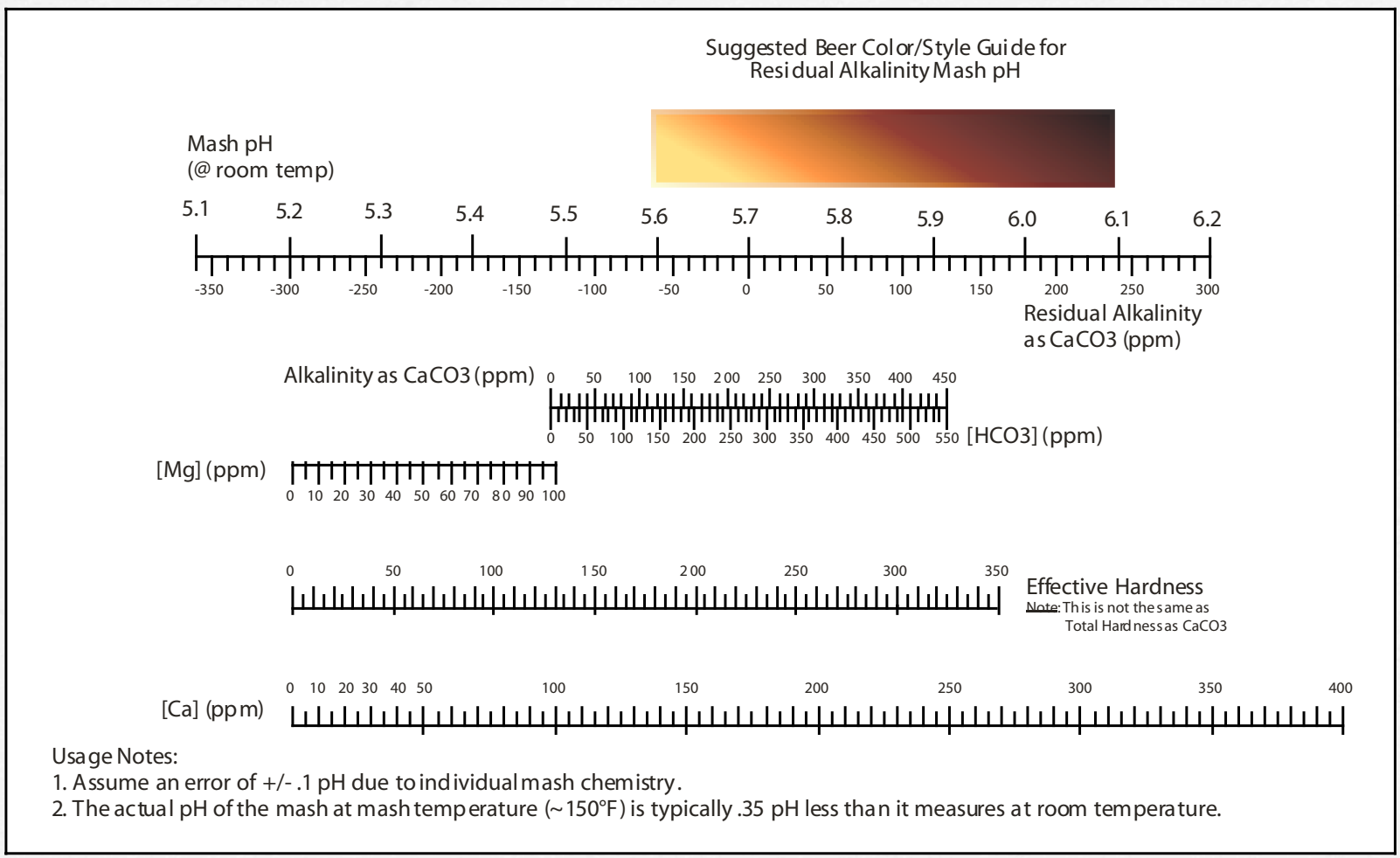

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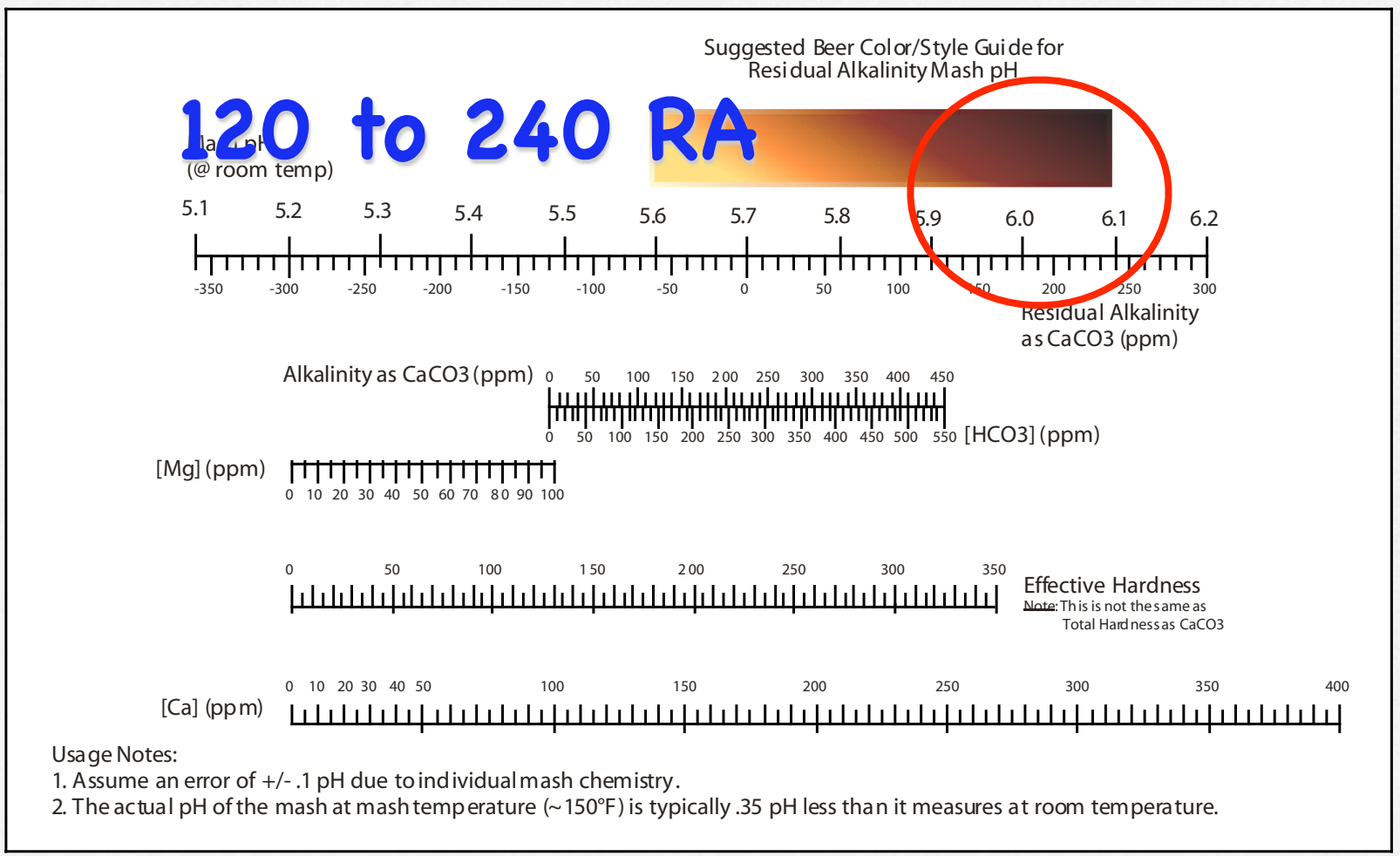

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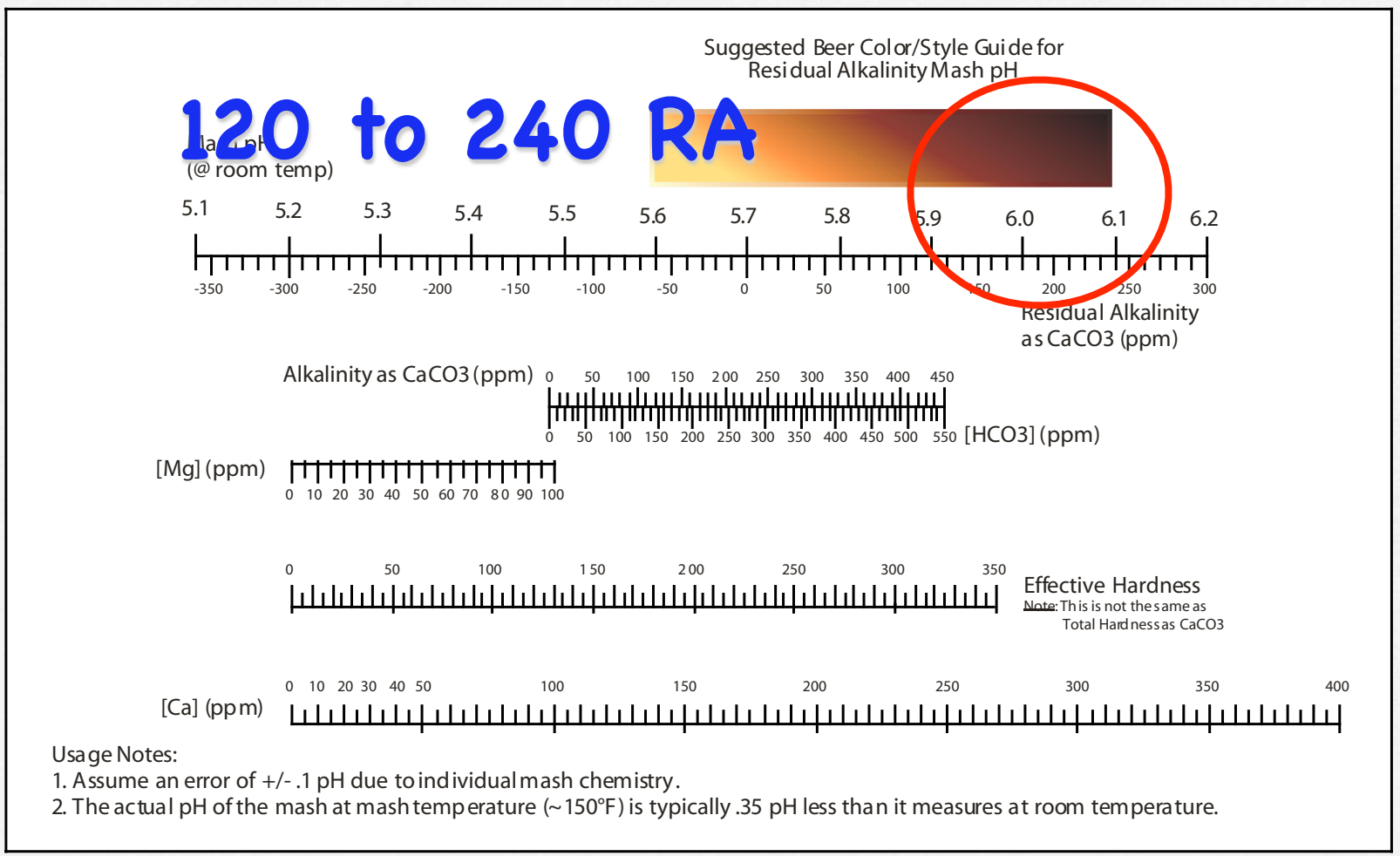

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Working with Salts

- *Most calcium salts do not like to dissolve into water very much.*
- *Best Method:*
  - *Add Salts to the Mash, according to mash water volume.*
  - *Sparge with a neutral or low salt water - Won't change pH much.*
  - *Add remaining salt quantity for total boil volume to the boil.*

Last Year's Experiment

- *Rick Bobbitt, Scott Jackson, and I made 4 beers:*
  - *Pale ale with RA = -50*
  - *Pale ale with RA = 200*
  - *Sweet Stout with RA = -50*
  - *Sweet Stout with RA = 200*
- *Beers with the right RA were complex, beers with the wrong RA were 1 dimensional.*

Palmer's Precipitous Pale

- *7 lbs. 2 Row Malt*
- *2.5 lbs. Vienna*
- *1 lbs. Briess Carapils*
- *0.5 lbs. Caramel 40*

- *.75 oz. Horizon @ 60*
- *0.5 oz Amarillo @ 30*
- *0.5 oz Willamette @ 15*

- *OG 1.050*
- *41 IBUs*
- *Color 6 SRM (Morey)*
- *White Labs WLP 001*
  - *California Ale*

Pale Ale Results

- *Pale Ale w/ RA = -50*
  - *Yield 71%*
  - *OG 1.046*
  - *FG 1.009*
  - *AA = 80%*
  - 5.5 Mash pH
  - 4.5 Beer pH
- *Pale Ale w/ RA= 200*
  - *Yield 71%*
  - *OG 1.046*
  - *FG 1.010*
  - *AA = 78%*
  - 6.1 Mash pH
  - 4.7 Beer pH

Palmer's Sweet 4N Stout

- *7 lbs Briess 2 Row*
- *1 lbs. Roast Barley*
- *1 lbs. Briess Carapils*
- *0.5 lbs. Caramel 40*
- *0.5 lbs. Caramel 80*
- *0.5 lbs. Special Roast*
- *0.5 lbs. Dark Choc. malt*
- *0.5 lbs. Black Malt*

- *1.5 oz Challenger @ 60*
- *0.5 oz Willamette @ 15*

- *OG 1.050*
- *36 IBUs*
- *Color 45 SRM (Morey)*
- *White Labs WLP 001*
  - *California Ale*

Stout Results

- Stout w/ RA = 200
  - Yield 69%
    - 4 gallons
  - OG 1.054
  - FG 1.016
  - AA = 70%
  - 5.4 Mash pH
  - 4.6 Beer pH
- Stout w/ RA = -50
  - Yield 66%
    - 4.5 gallons
  - OG 1.055
  - FG 1.018
  - AA = 67%
  - 4.9 Mash pH
  - 4.2 Beer pH

Caveat on Color

- *When it comes to color, there are basically two kinds of malts: Kilned and Roasted*
  - *Kilned: base malt, Munich, Crystal, Aromatic*
  - *Roasted: Chocolate, Black, Roast Barley*
- *Roasted malts are DARKER and MORE ACIDIC for the same SRM measurement.*

Go To Briess Presentation

- ***http://www.brewingwithbriess.com/Assets/Presentations/Briess_2008CBC_UnderstandingBeerColor.ppt***

And This Means....

- *If you are trying to plan the RA for a 20 SRM beer, you have the choice of a low RA or a high RA value for that color based on how acidic you think that grainbill is.*
  - *Ex. Spreadsheet says*

Step 1: Enter Target Beer Color to see range of suggested Residual Alkalinity, Or Enter a Target Water Prof calculated Residual Alkalinity value and a range of suggested Beer Color. (Choose either "Bicarbonate" or Alkalinity" in E11 and enter the appropriate value in E10.)

Target Color (SRM)	Est. RA (Low)	Est. RA (High)				
20	122	181	OR			