

Water Chemistry of Minnesota Calcareous Fens

1995 Water Chemistry Criteria

- pH of 6.7 or more;
- calcium of 30 mg/l or more;
- alkalinity of 1.65 meq/l or more;
- dissolved oxygen of 2.0 mg/l or less; and,
- specific conductance of 500 $\mu\text{S}/\text{cm}$ or more

- Water Chemistry that meets these criteria would allow calcium carbonate to be deposited in and/or on the soil surface, creating the marly deposits that are observed in many calcareous fens.

How Did Real Life Measure Up?



Inquiring Minds.....

pH > 6.7?

- Minimum pH = 6.38, only one below the threshold
- Maximum pH = 8.30
- 6.38: Cannon River Valley Wilderness Area

Specific Conductance > 500 $\mu\text{S}/\text{cm}$?

- Minimum 242
- Maximum 1874
- 242: Cannon River Valley Wilderness Area
17 others under the threshold

Calcium > 30 mg/l?

- Minimum = 24
- Maximum = 728

- 24: Sheldon 16 in Houston County

Alkalinity > 80 mg/l as CaCO₃?

- Minimum 67
- Maximum 1227

- 67: Cannon River Valley Wilderness Area

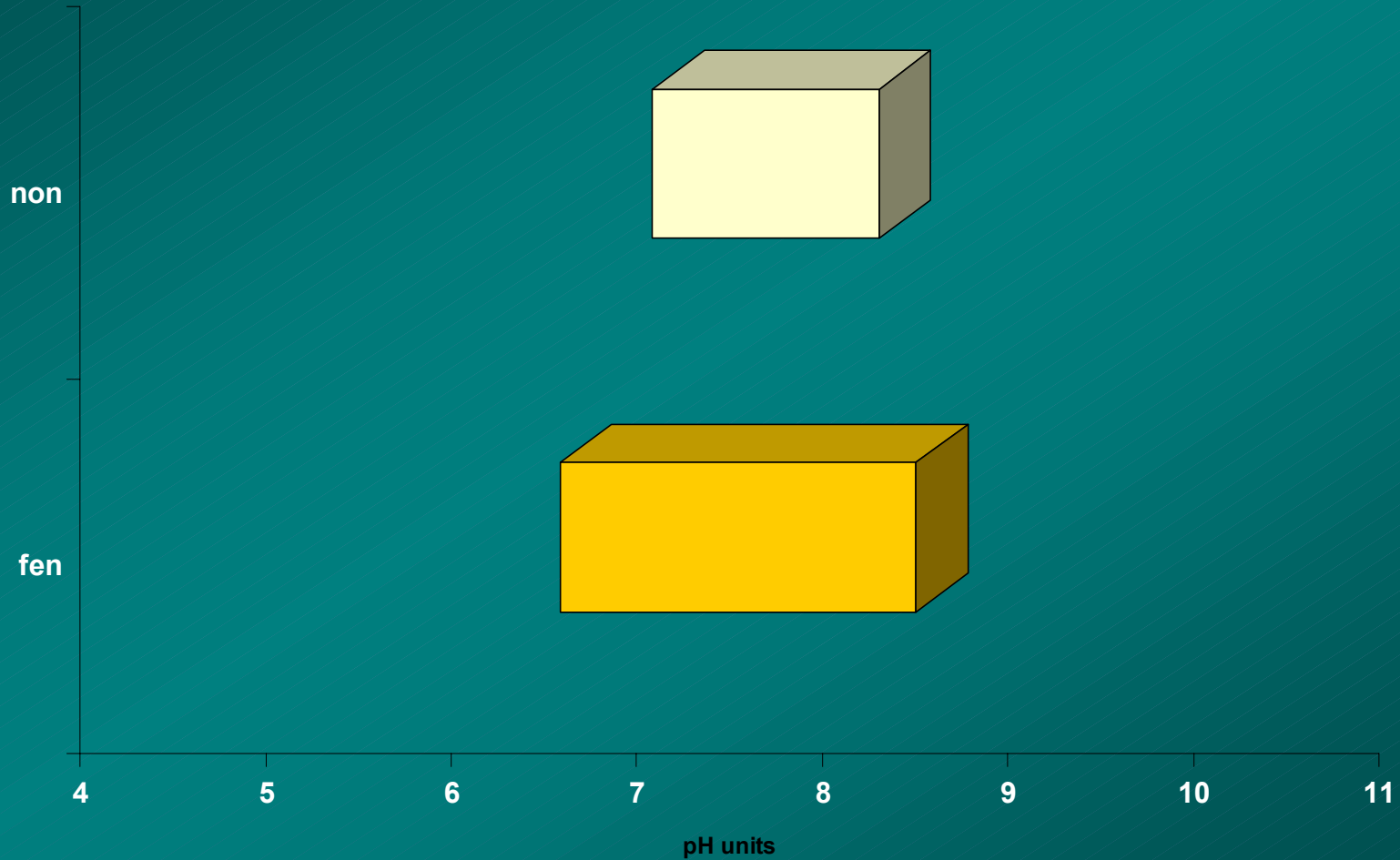
Can These Parameters Tell Fen From Non-Fen?

- Our work involved collecting data from control sites throughout the state in the same areas where we were sampling calcareous fens.

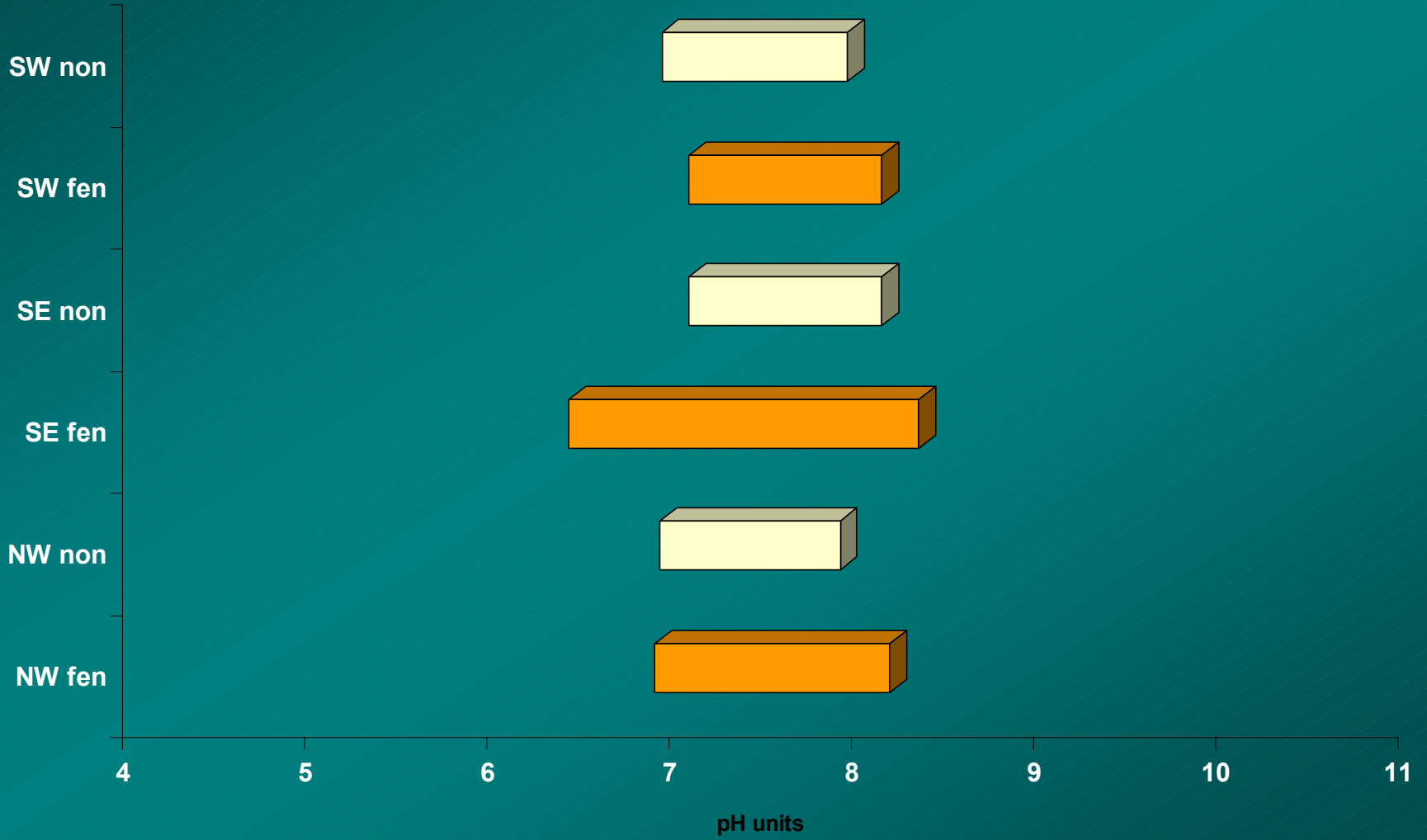
pH > 6.7 At Controls?

- Minimum pH = 6.88
- Maximum pH = 8.09

Comparison of pH between Fens and Control Sites



Regionalized Comparison of pH

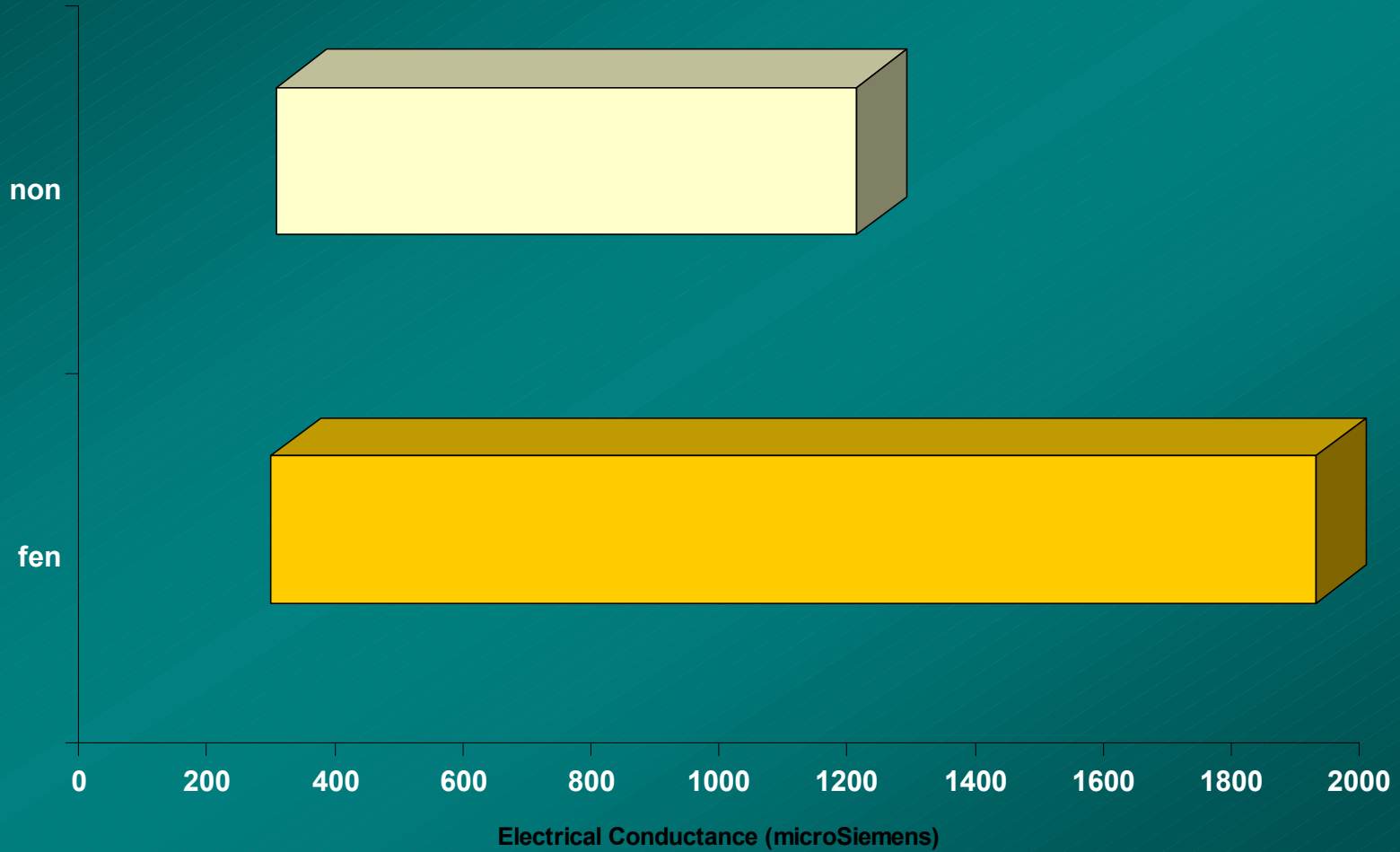


Specific Conductance > 500 $\mu\text{S}/\text{cm}$ At Controls?

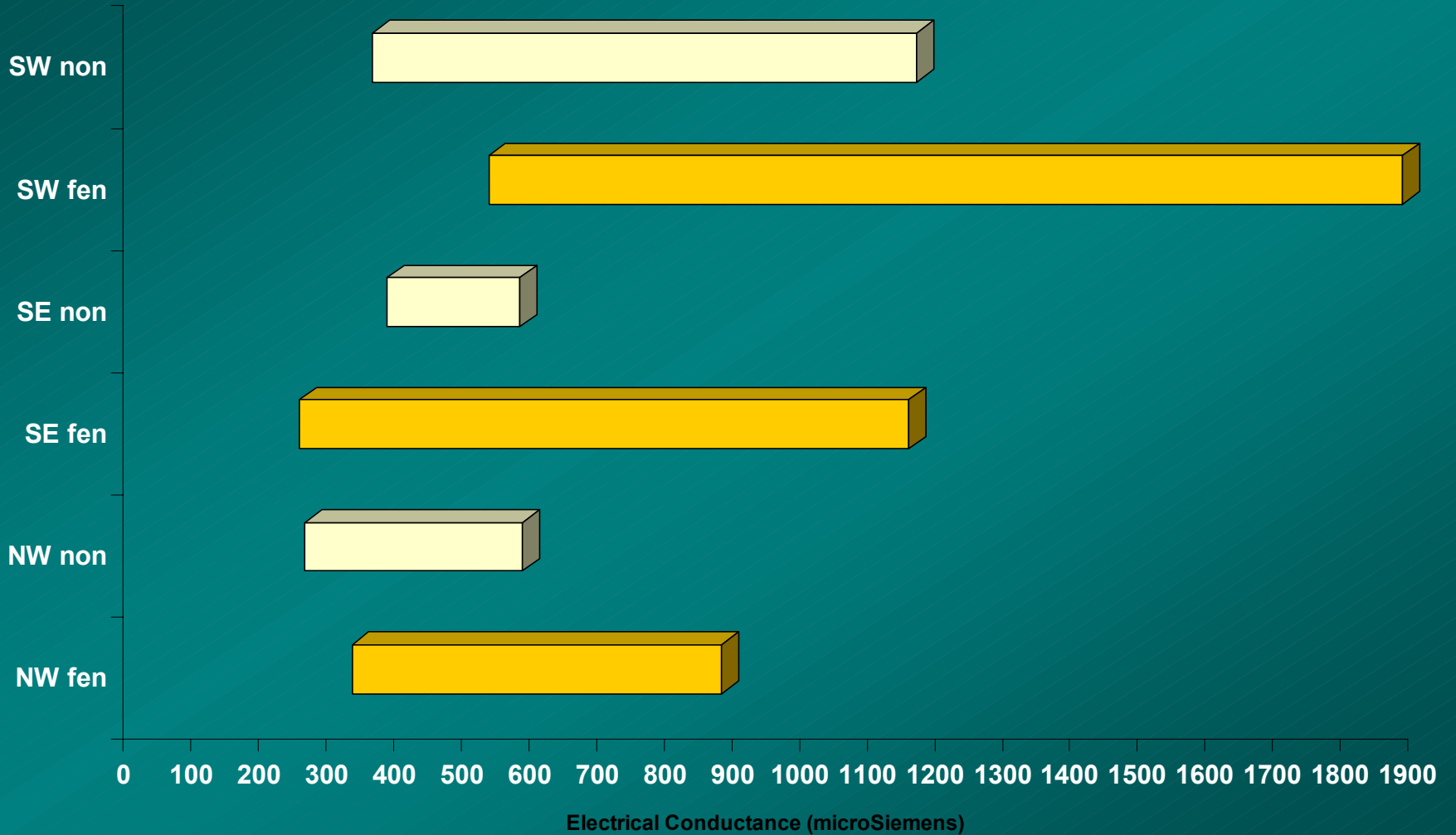
- Minimum 250
- Maximum 1155

- 250: Sanders Cattail Swamp
11 of 28 under the threshold

Comparison of Conductance in Fens and Control Sites



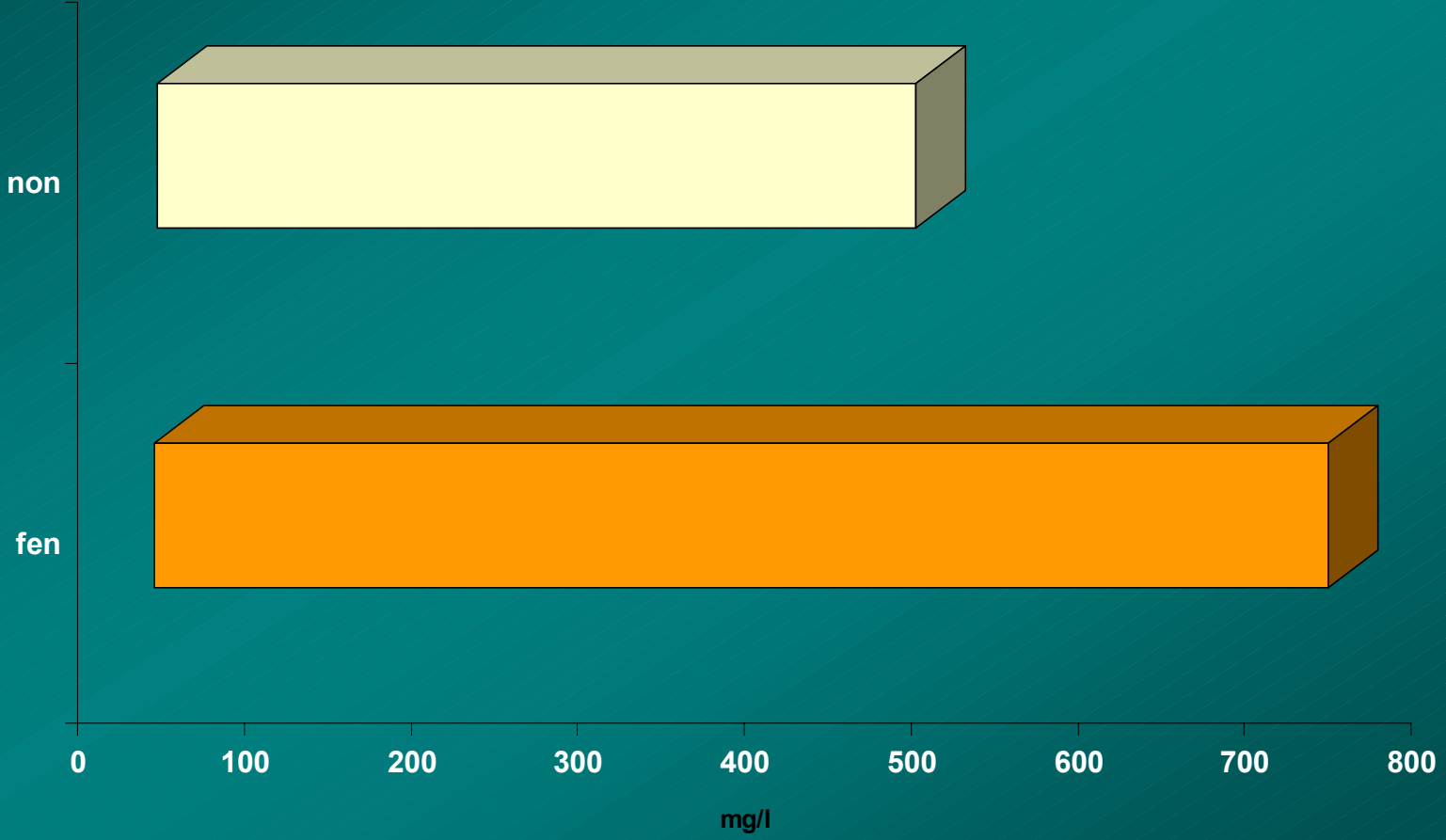
Regionalized Conductivity Comparison



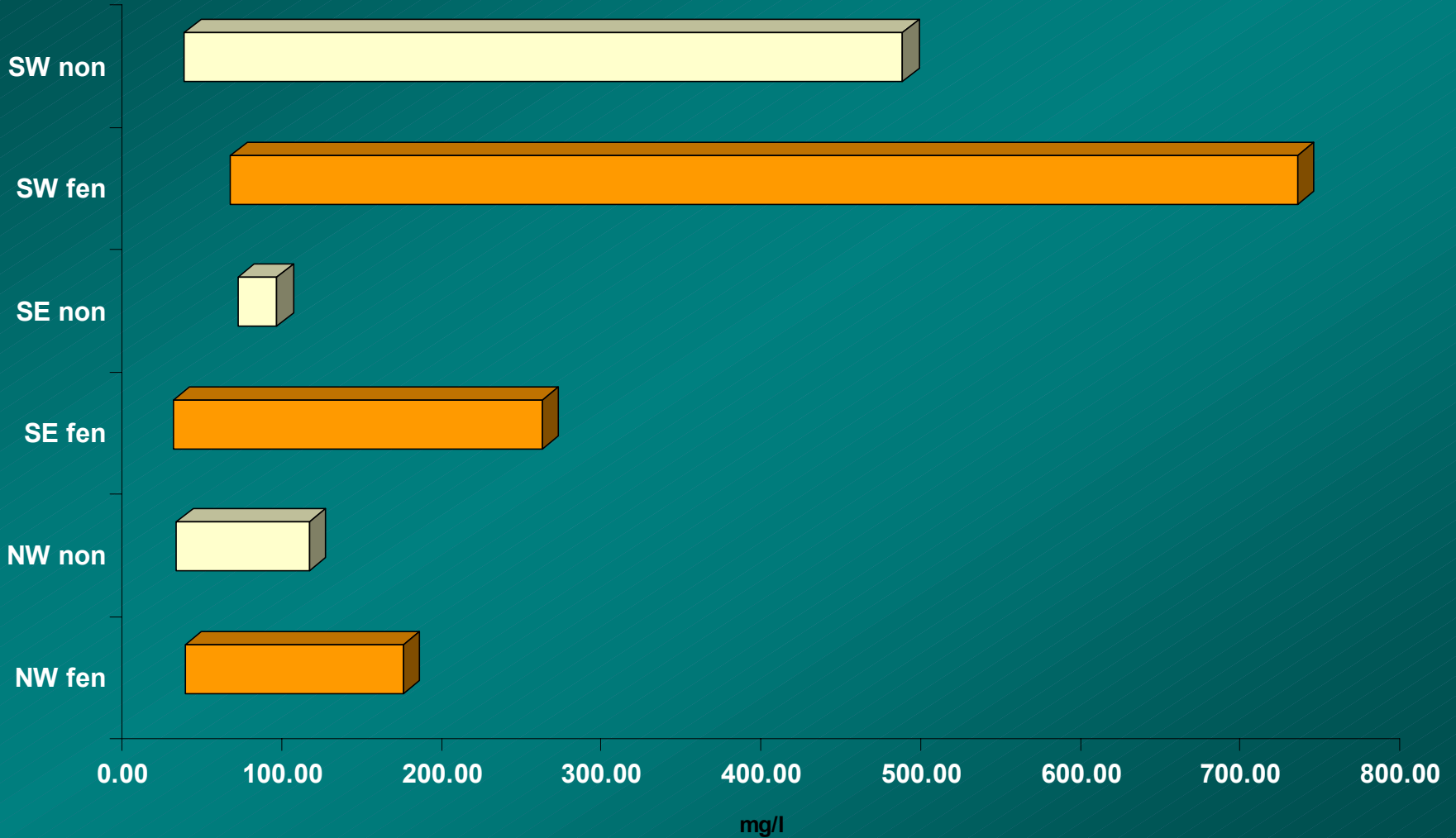
Calcium > 30 mg/l At Controls?

- Minimum = 109
- Maximum = 440

Calcium Comparison



Regionalized Comparison of Calcium

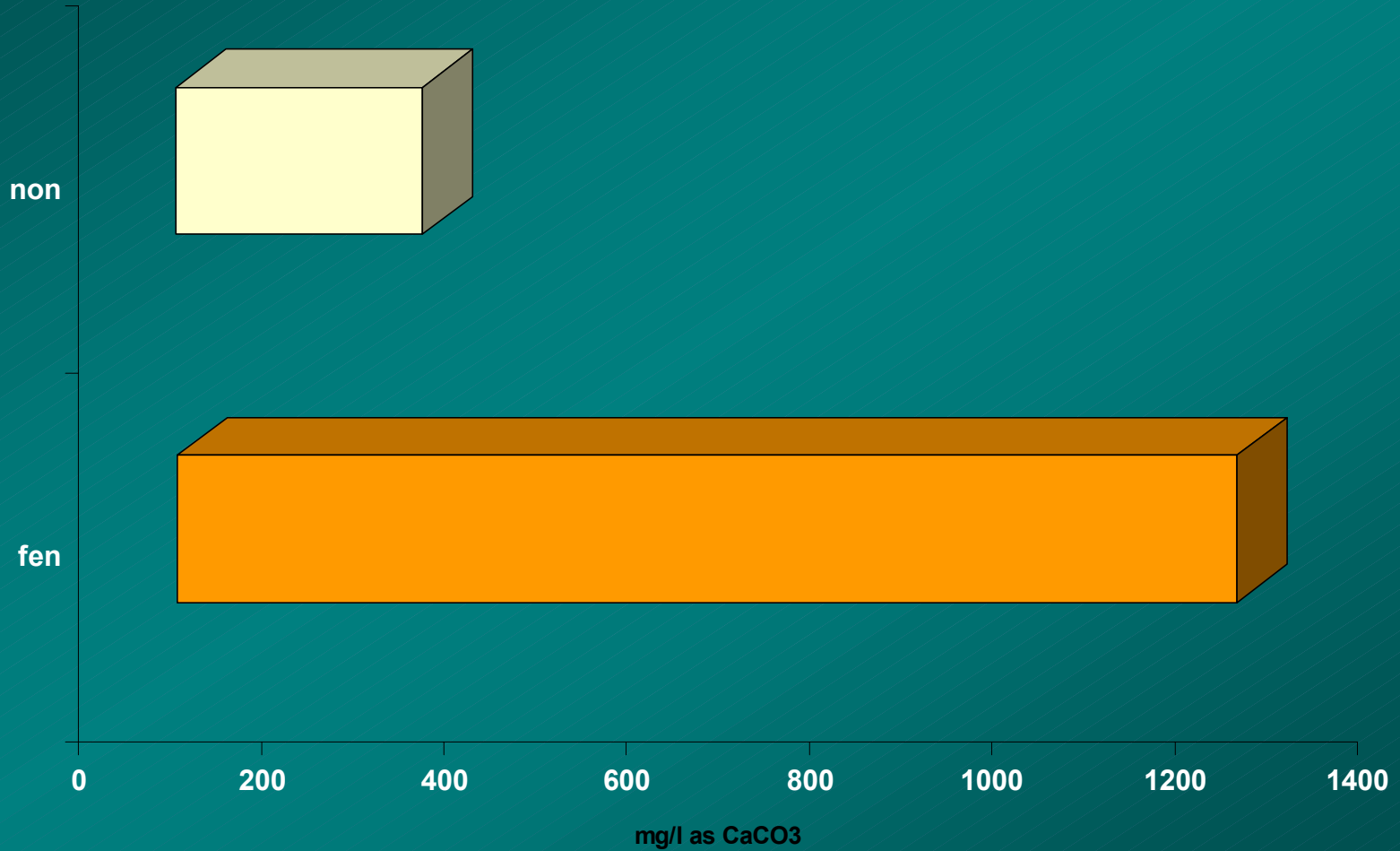


Alkalinity > 80 mg/l as CaCO₃ At Controls?

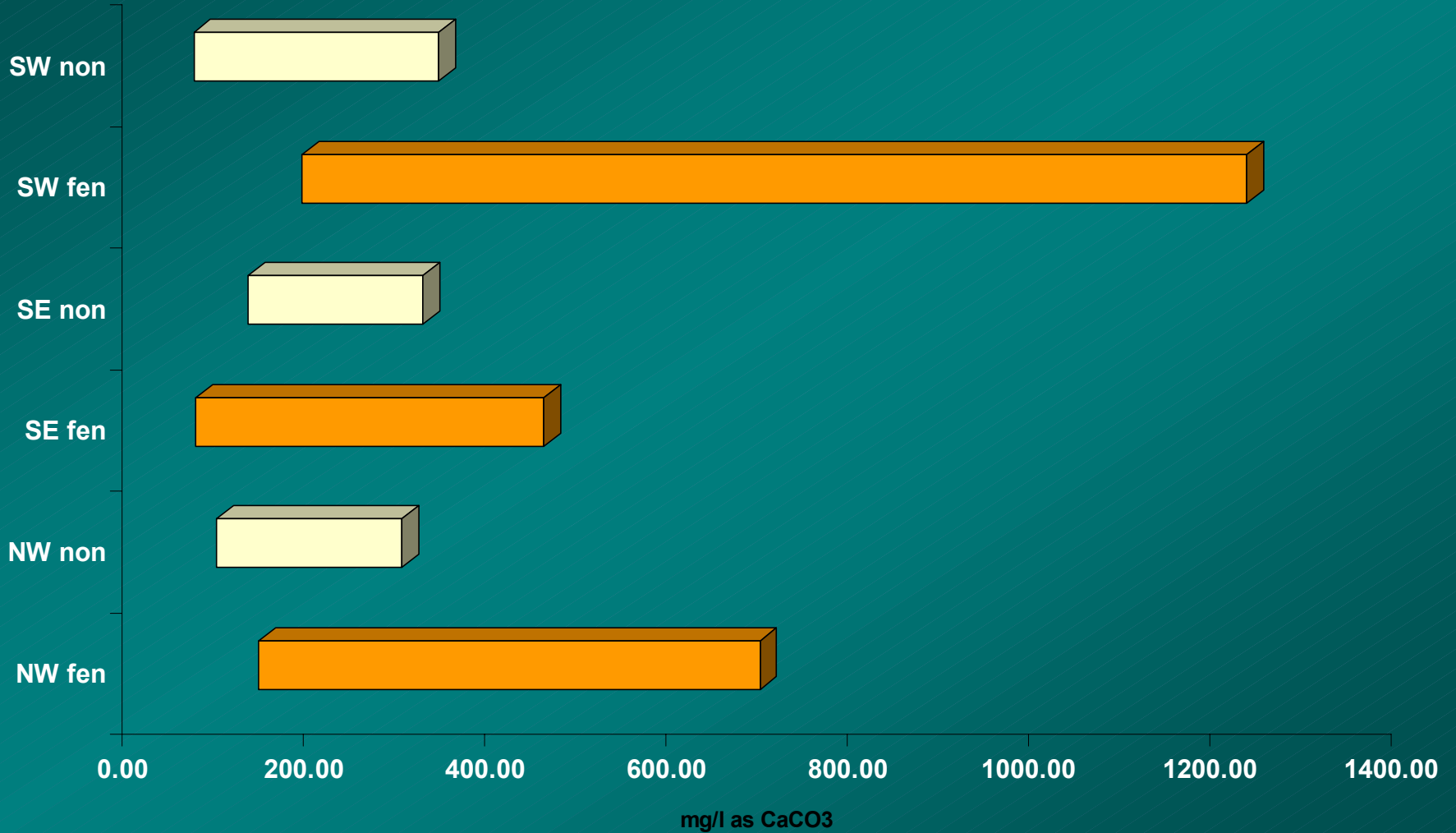
- Minimum 65
- Maximum 335

- 65: South Slough near Sioux Nation Fen

Alkalinity Comparison



Regionalized Comparison of Alkalinity



How can this be?



Are we missing something here?

Take a Moment to Consider....



what we knew when we set up the criteria:

- Data from only 6 calcareous fen sites
- None of the available data were from calcareous fens in the 'true' Southeast, only from the Minnesota River Valley
- As you've just learned from Jim's talk, the location of a sample with respect to the discharge zone can influence water chemistry results
- As you learned from George's talk, SE fens do not always deposit calcium carbonate near the soil surface, which was the whole premise of the initial water chemistry criteria

- Only a much larger database can help us understand the variability of these parameters because climate differences between the far corners of this state have an impact on the water balance, all else being equal, and thus on water chemistry

Conclusion

- Soil, Hydrology, and Water Chemistry can describe Calcareous Fens but not distinguish them from other similar wetlands in the same hydrogeomorphic setting.
- The vegetation criteria (vascular and bryophyte) can distinguish between fen and non-fen in intact settings.

So Why Bother?

- Because the Soils, Hydrology, and Water Chemistry provide the necessary habitat for the Calcareous Fen Plant Community, these are the factors that are monitored when the health or sustainability of a Calcareous Fen might be impacted by anthropogenic influences.