Diurnal Dissolved Oxygen Monitoring: Optical versus Membrane Sensors

Thomas Amidon
Omni Environmental LLC

8th Water Monitoring Summit
West Trenton, NJ
December 2nd, 2011

OMNI ENVIRONMENTAL LLC

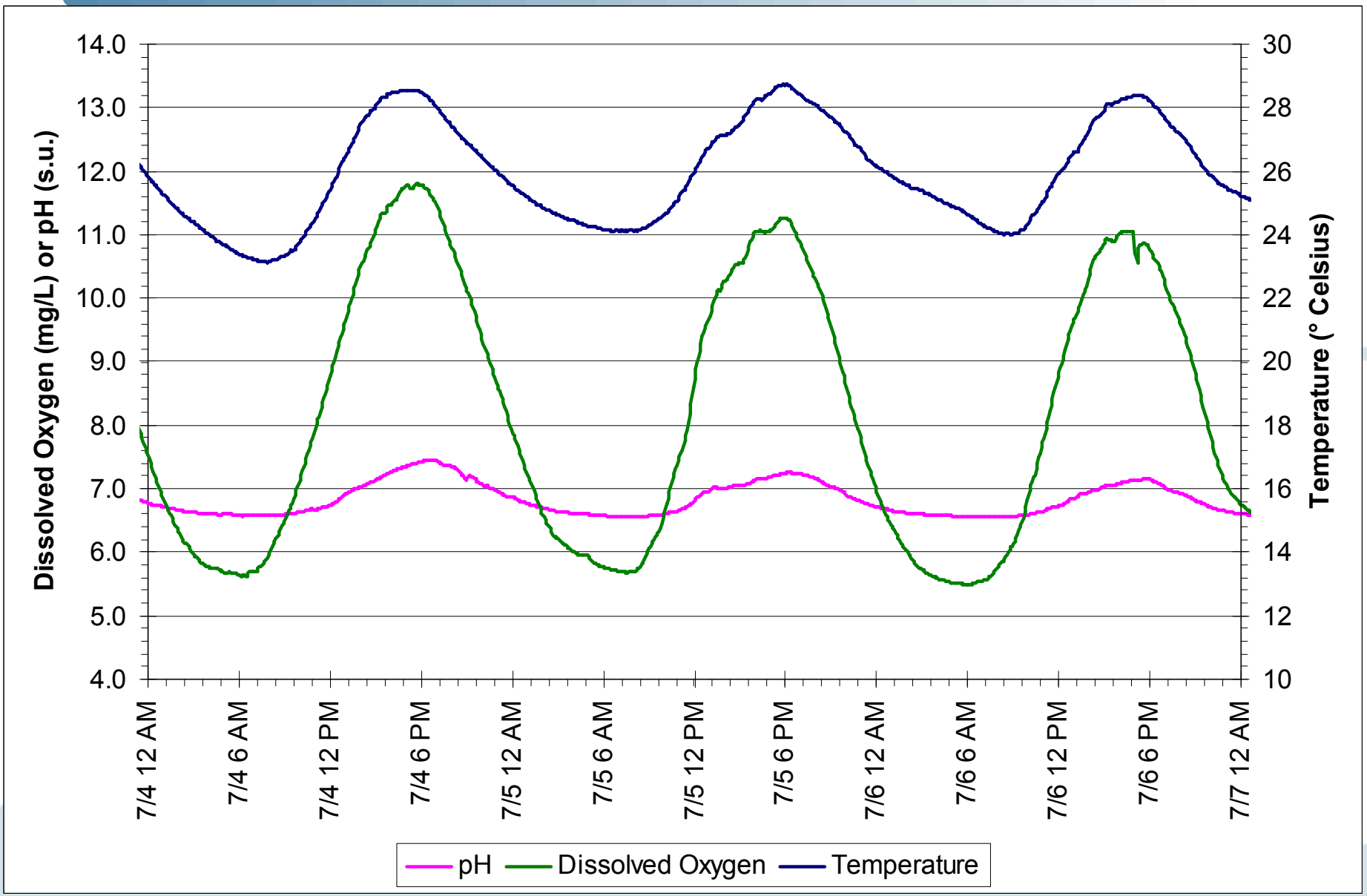
Acknowledgements and Outline

- Acknowledgements
  - Joe “JJ” Schwarz, Omni Field Sampling Manager
    - Managed all field activities and assembled data
  - Glen Petrauski, SRVSA
    - Client for whom comparative data were obtained
  - United States Geological Survey
    - Continuous water quality data in Raritan River @ Manville
- Outline
  - Why is it important?
  - Ways to measure DO
  - A few interesting comparisons
  - Conclusions

Why is Diurnal DO Monitoring Important?

- DO, pH, temperature, as well as conductivity and turbidity, are frequently measured *in-situ* and diurnally in surface waters
  - *In-situ:* measurements performed in the field
  - Diurnal: measurements performed throughout the day
- DO and pH in particular can be used to assess the net impact of biochemical processes on surface water quality
  - Photosynthesis
  - Respiration
  - Decay (decomposition)
- Levels and diurnal swings of DO and pH are useful in assessing nutrient impacts

Example Diurnal Swing



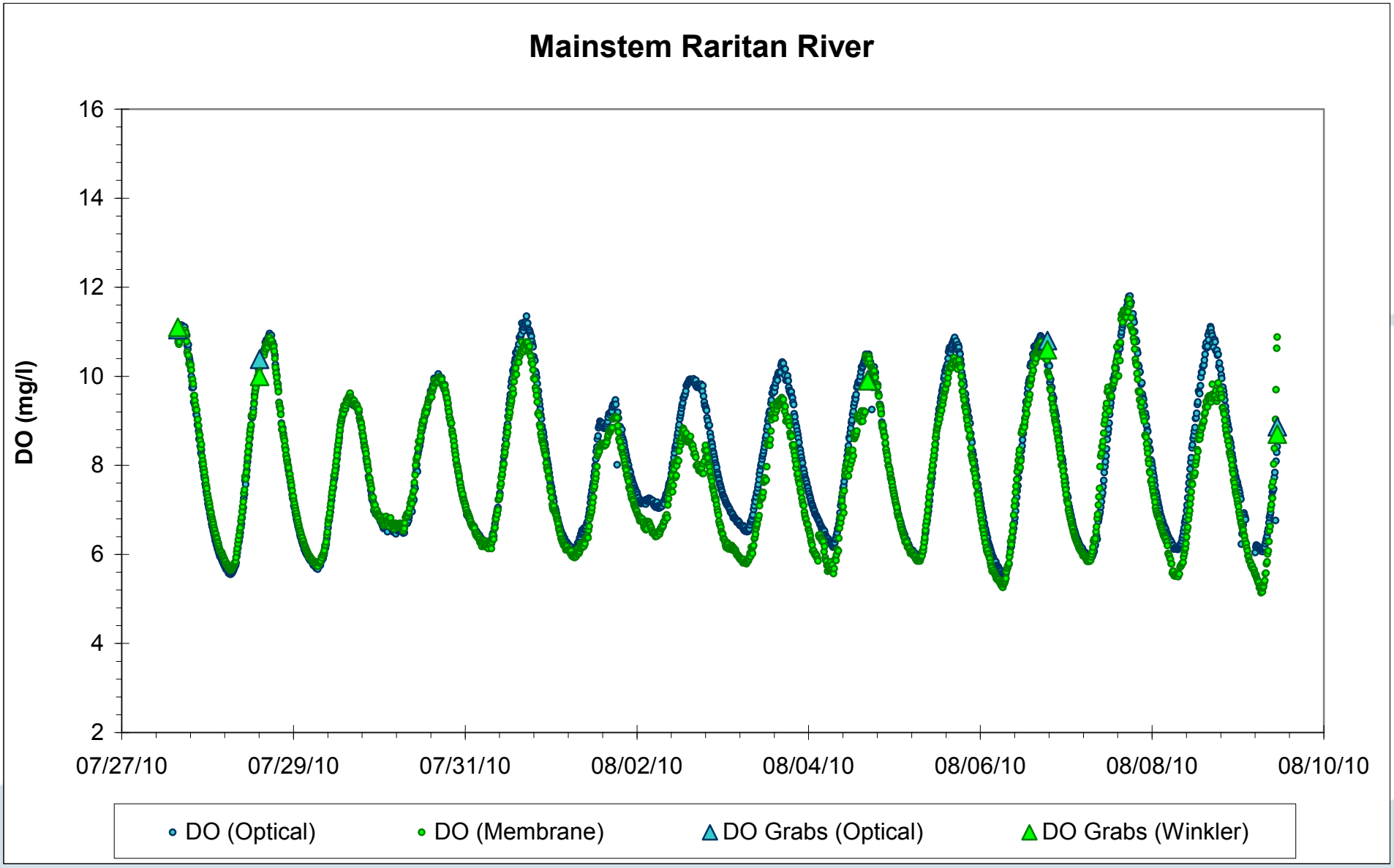
Ways to Measure DO

- Winkler Method
  - Preserve sample in a bottle and titrate later in lab
  - The oldest tried and true method
- Sensor methods
  - Used in portable meters as well as *in-situ* meters
  - 2 types of technology
    - Membrane (aka Clark cell or amperometric method)
    - Optical (aka luminescent sensor)

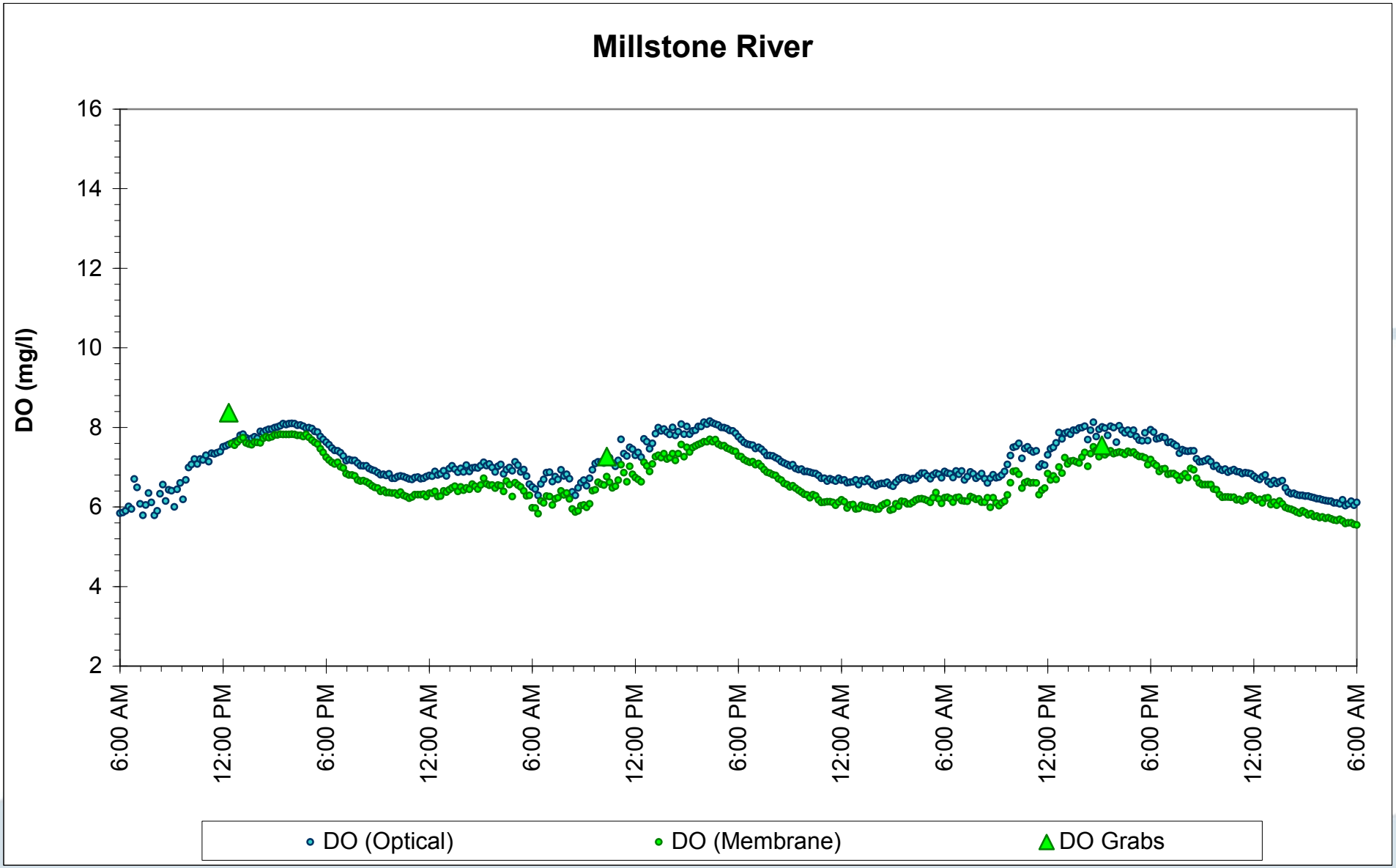
Advantages and Disadvantages

- Winkler method
  - Nobody is going to argue with the results
  - No meter calibration – simplest method by far
  - Disadvantage – only one sample at a time!
- *In-situ* Sensor Methods
  - Membrane Sensor
    - Certified method!
    - Method has been in use for many years and is accepted
  - Optical Sensor
    - No consumbles (membrane and filling solution)
    - No stirring required and no known interference
    - Not yet certified for all uses in State of New Jersey

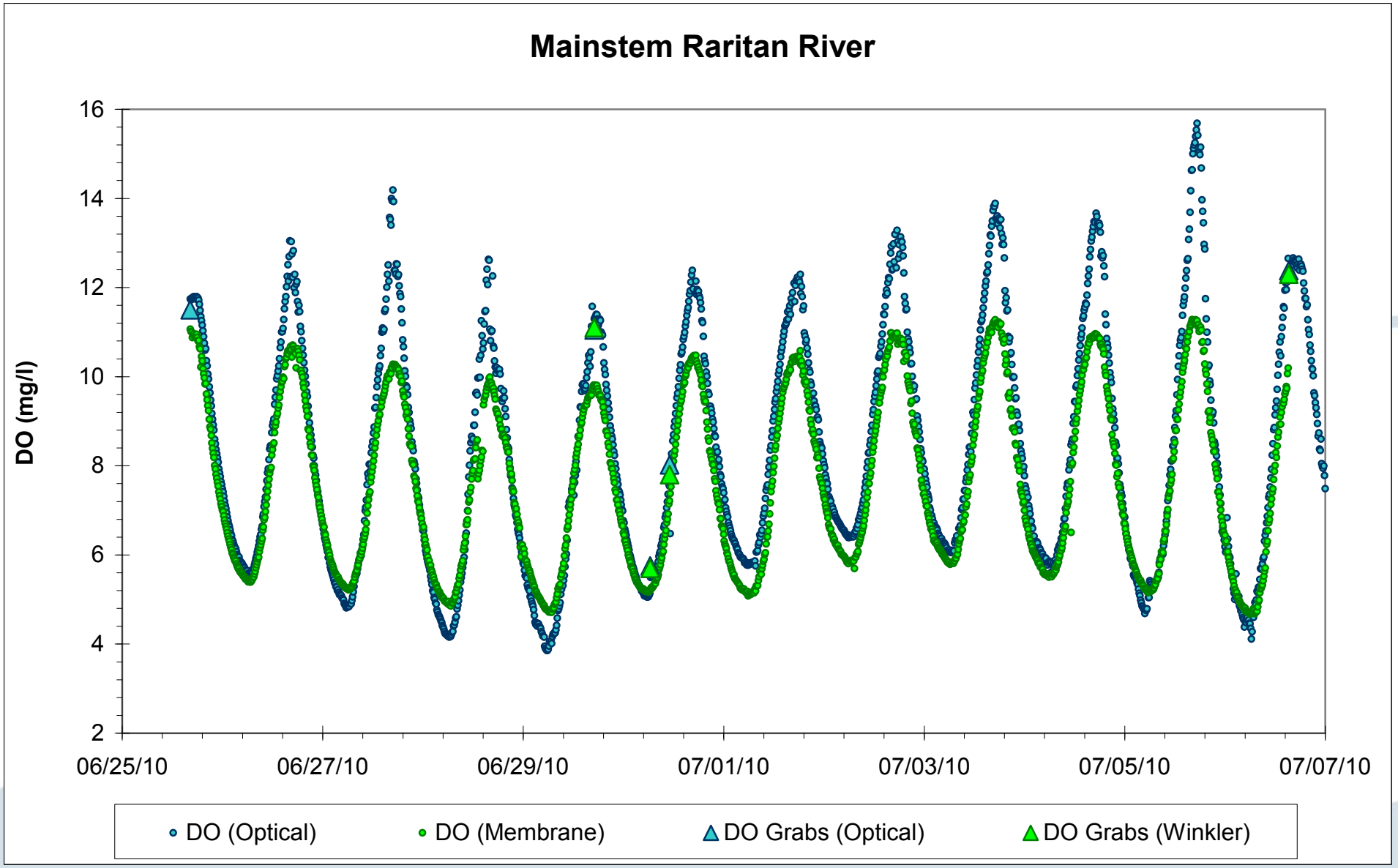
Both Sensors Perform Very Well



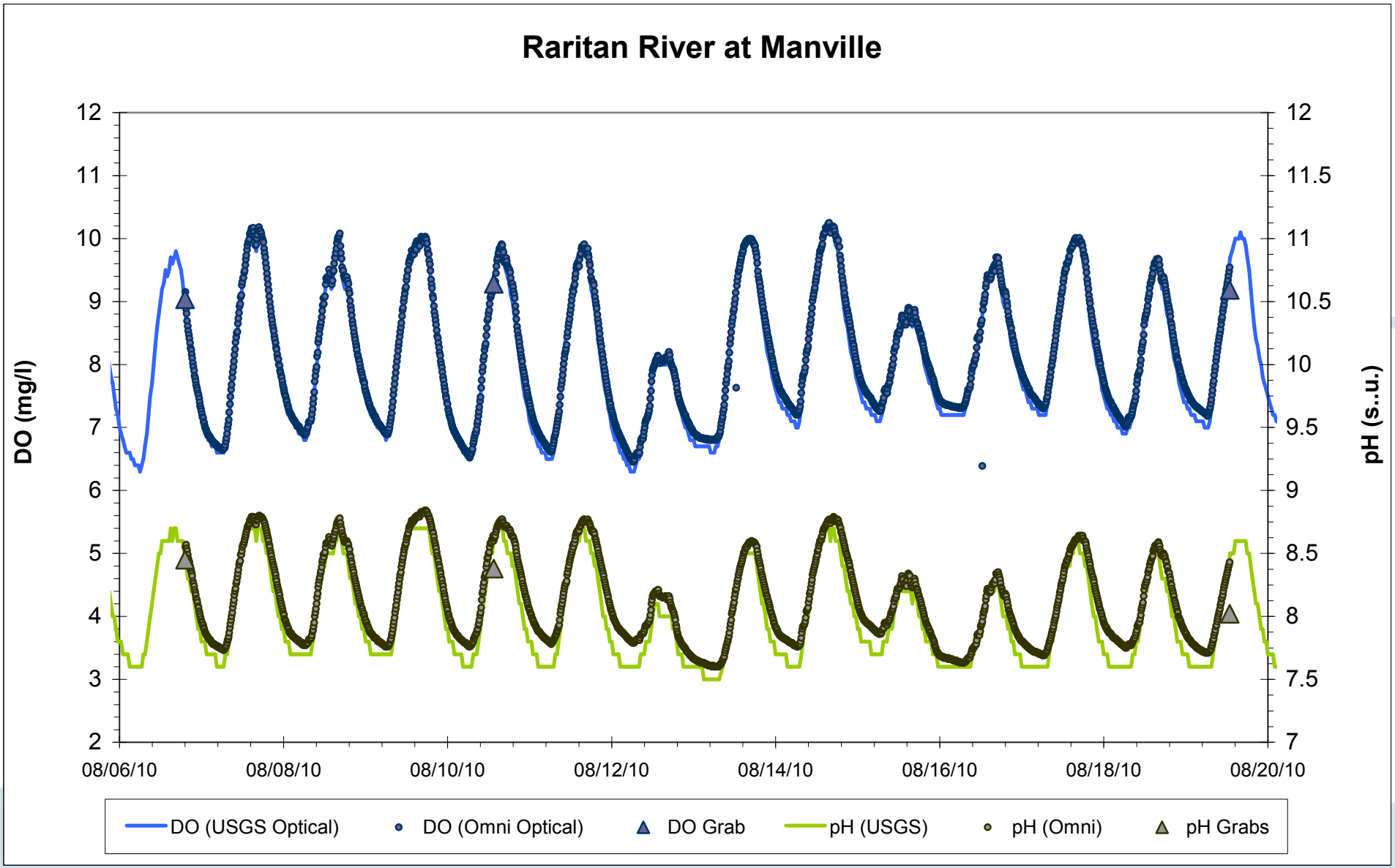
Both Sensors React Similiarly



Optical DO Sensors Capture Peaks



Optical Sensor Reproducibility



Conclusions

- Both methods can produce excellent *in-situ* results
- If regulatory approval is required, be sure to specify method in quality assurance plan
- For diurnal deployment, optical sensor enjoys a few key advantages
  - Less susceptible to biofouling and other interferences
  - Better performance in low DO environments
  - Might capture peaks better under certain conditions
  - Better performance in low velocity environments
  - Usually holds calibration longer
- Optical sensor must be conditioned prior to deployment
  - Important part of meter calibration
  - Requires overnight (plan ahead!)

Questions and Discussion

www.Omni-Env.com

Thomas Amidon
Senior Associate
Water Resources Manager
609-924-8821 x128
TAmidon@Omni-Env.com

Joseph W. Schwarz
Senior Engineer
QA/QC Field Manager
609-924-8821 x119
JSchwarz@Omni-Env.com