NEWEA 2016 Annual Conference
Operator Ingenuity Session

Instruments and Methods used for Process Monitoring and Control of the North Attleborough, MA WWTF

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Tighe&Bond

Outline

- Plant Overview
- Goals
- Instrumentation Introduction
- Equipment O&M
- Instrument Capabilities
- Final Thoughts

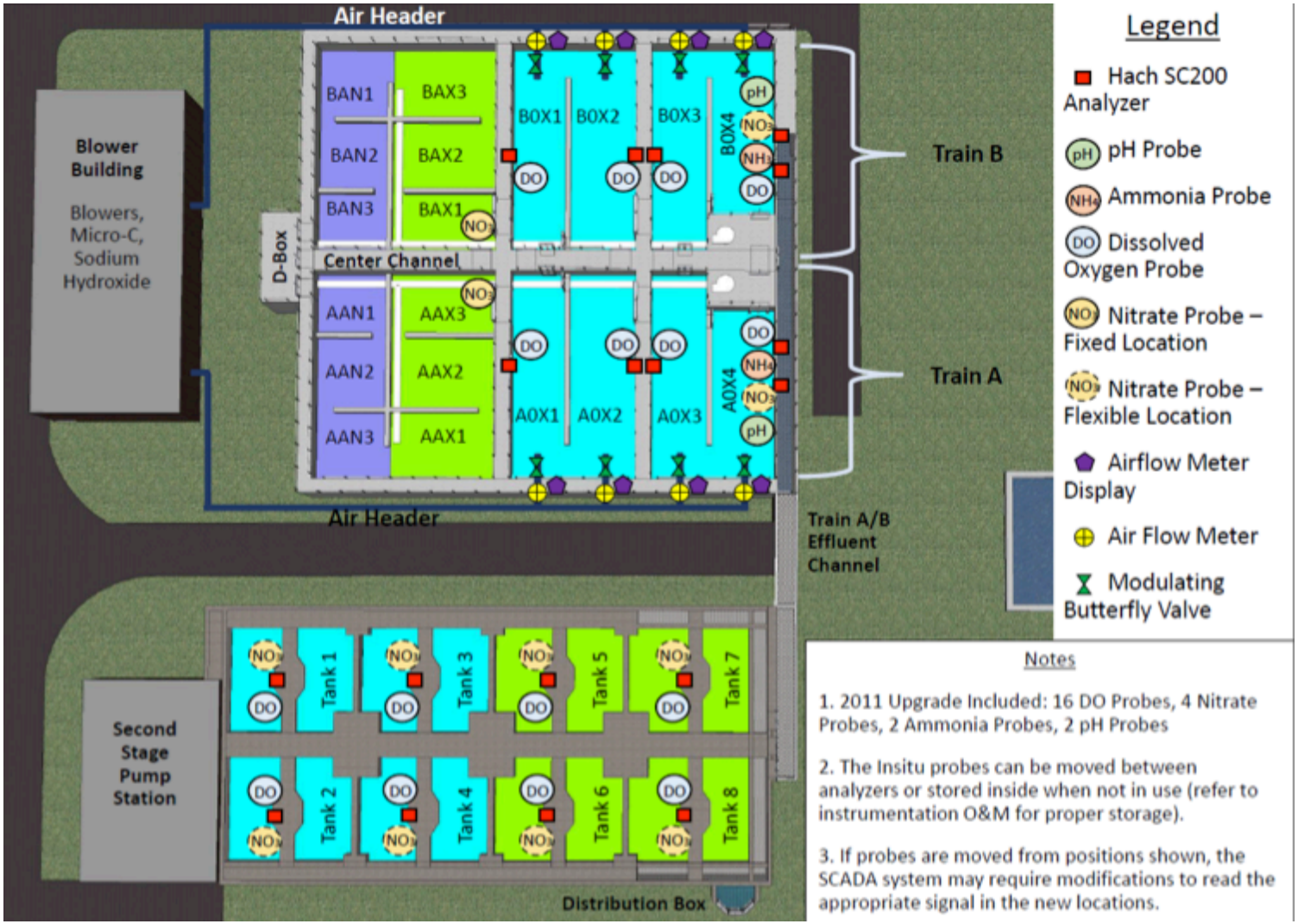
WWTF Overview

- **New 5-stage Bardenpho process**
- **New tertiary filtration system**
- **Upgrades to:**
  - Pump stations
  - Headworks building
  - First stage and RAS pumps
  - Odor control System
  - Plant water system
- **Treatment Goals**
  - Nitrogen removal
    - » Total nitrogen = 8 mg/L May-Oct
    - » Ammonia = 1 mg/L May-Oct
  - Phosphorus
    - » 0.1 mg/L Apr-Oct
    - » 1.0 mg/L Nov-Mar

WWTF Upgrade Commissioning – Process Monitoring Goals

- **Low level monitoring methods**
  - What is the best combination of approaches
    - » Field
    - » Insitu
    - » Colorimetric
- **Increased laboratory effort**
  - 2-person Staff
- **Instrumentation limits**
  - Reliability & Accuracy
  - Costs
- **What is best for Your Plant?**

Biological Nutrient Removal System - 5-Stage Bardenpho Process



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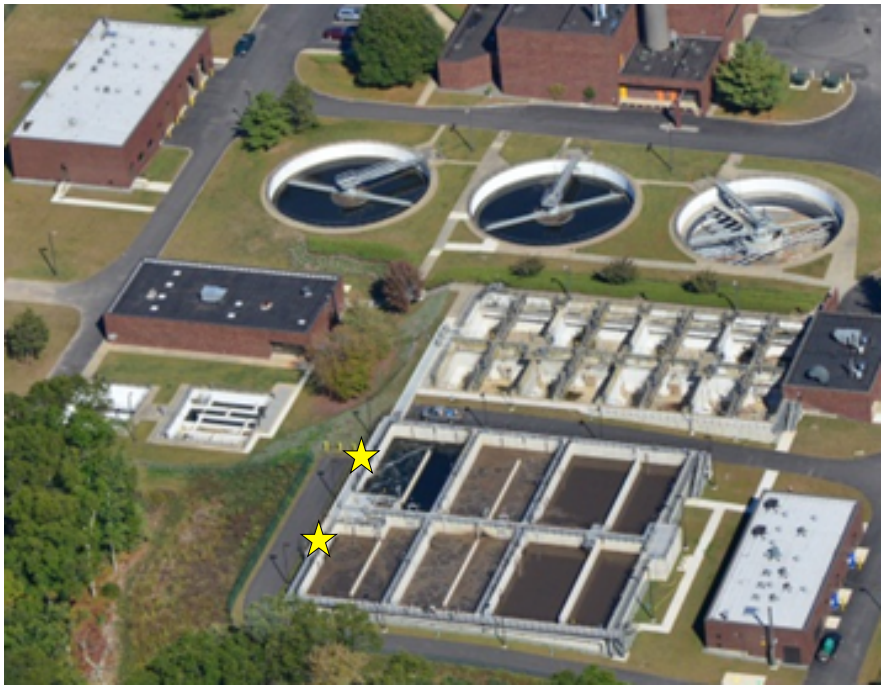
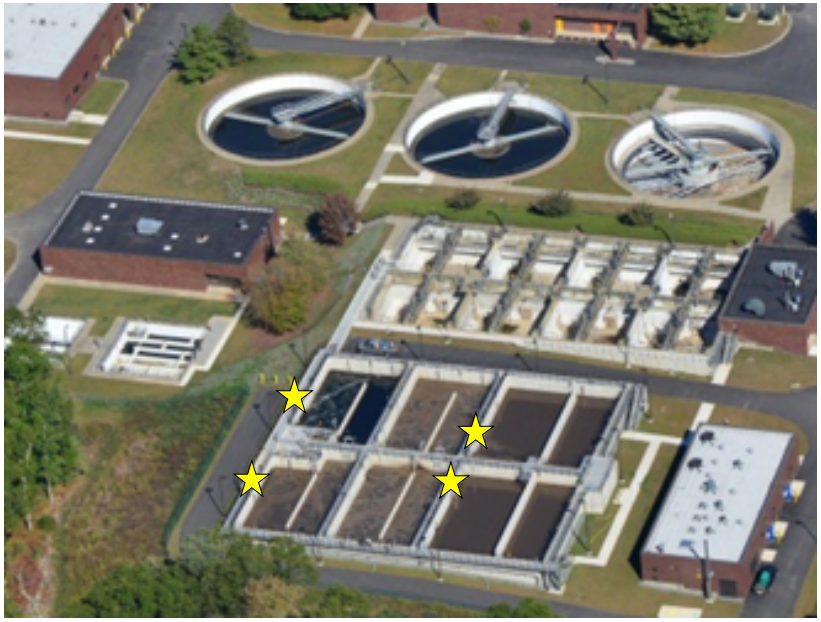
Insitu Instrumentation

- Ammonium Probes - *Hach A-ISE NH4 Probe*
  - End of Aeration Zones
  - No longer in use
  - ISE Probes not accurate < 2 mg/L
  - Could use @ influent for ammonia loading
  - O&M
    - » Clean every 1-2 weeks
    - » Matrix correct 1-2 per month
    - » Replace cartridge 2x/year



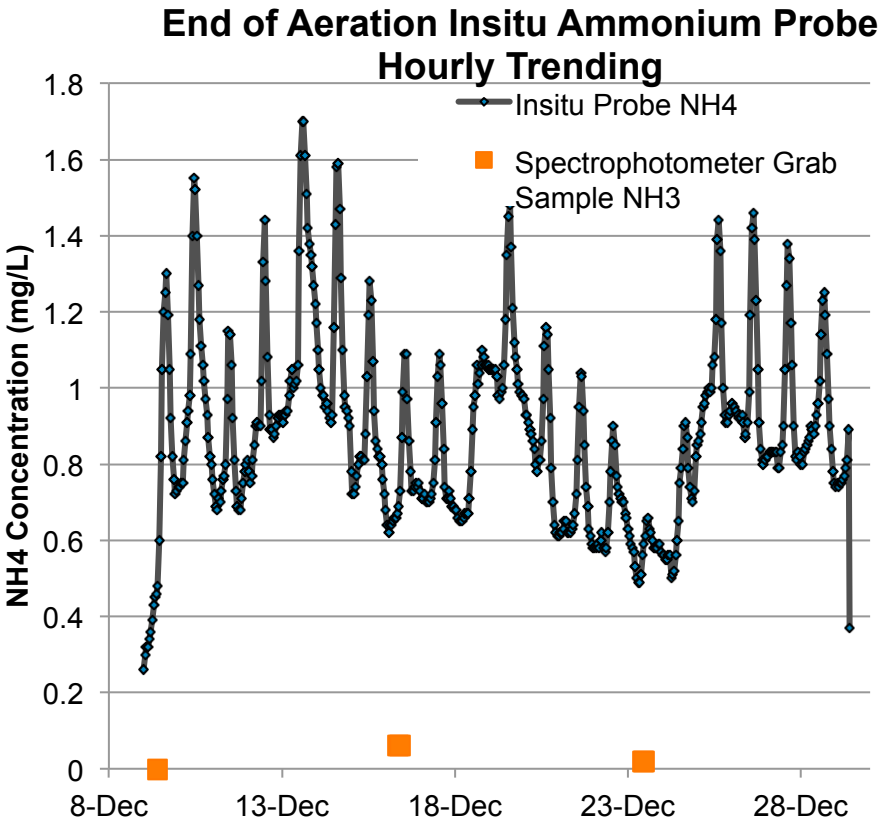
Insitu Instrumentation

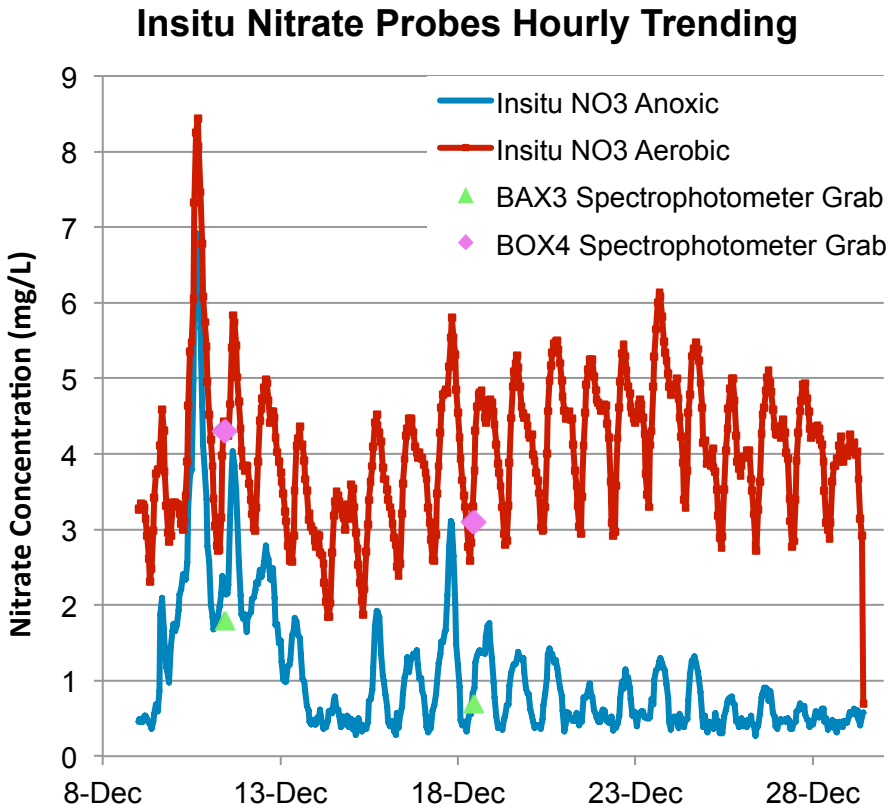
- Nitrate Sensors - *Hach NITRATAX Plus sc NO3*
  - Working well, reliable
  - End of Anoxic Zones
    - Mixed liquor recycle rate
    - < 1 mg/L = increase NO3 recycle
  - End of Aeration Zones
    - If NO_3 < 8 mg/L, Eff TN good
    - Eff TN reliably 2 mg/L less
  - O&M
    - Clean every 1 – 2 weeks
    - Calibrate as required
    - Replace wiper 2x/year
    - Replace seals annually



How Are The Instruments Working?
Ammonium & Nitrate Insitu Probes Trending

- Calibration & confidence has taken time
- Recently interfaced SCADA & WIMS
- Continue to evaluate accuracy
- Rely on for trending





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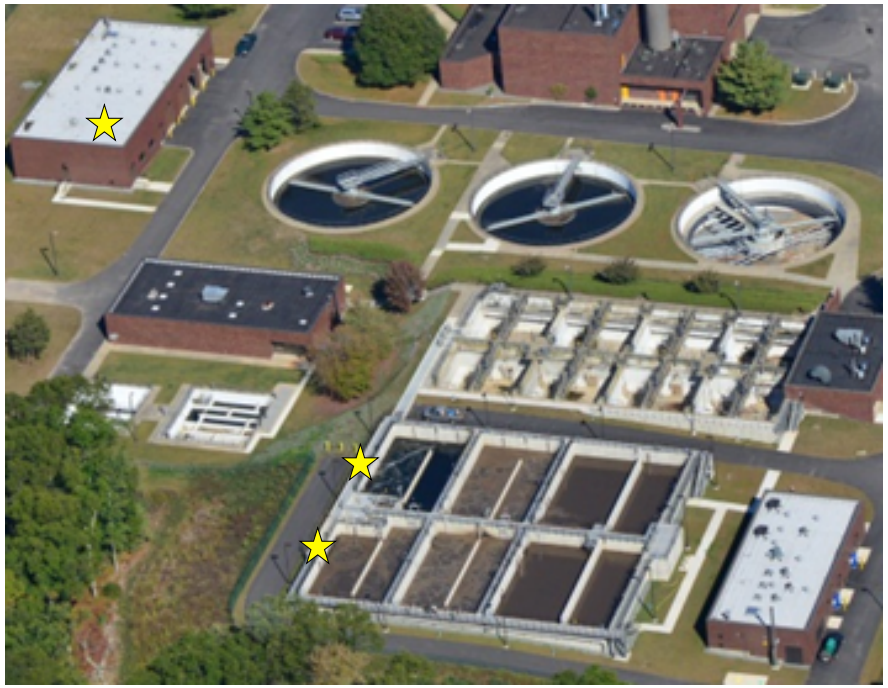
Insitu Instrumentation

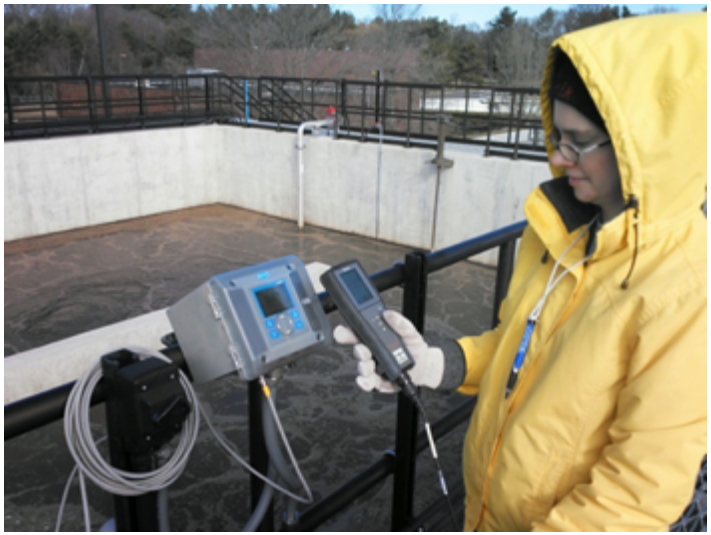
- pH Probes - Hach Differential pH Sensor
  - End of Aeration
    - » Monitor nitrification drop levels
  - Tertiary Building
    - » Before chemical addition
  - O&M
    - » Clean every 1-2 weeks
    - » Calibrate every 60 days
    - » Replace salt bridge annually

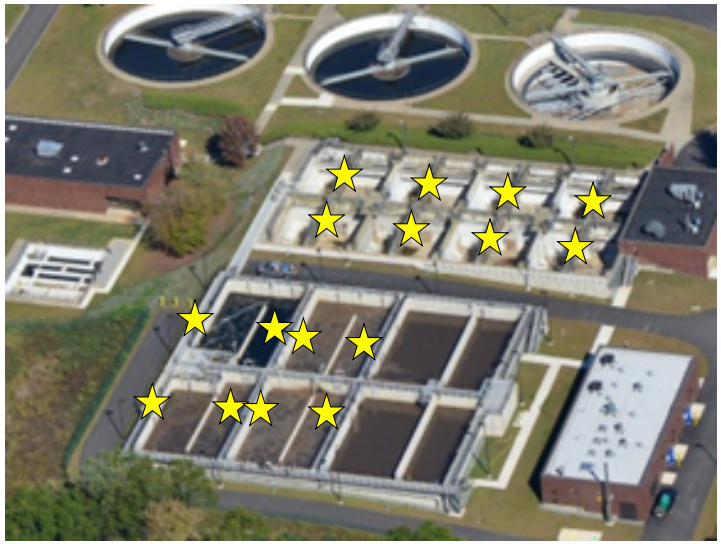


Insitu Instrumentation

- Dissolved Oxygen Probes - *Hach LDO*
  - Aeration Tanks
  - Trust for blower control
  - Confirm accuracy daily
    - » Adjust offset if needed
  - Clean weekly
  - Replace end cap annually

Stock photo from www.Hach.com





Insitu Instrumentation

- Turbidity Meter - Hach

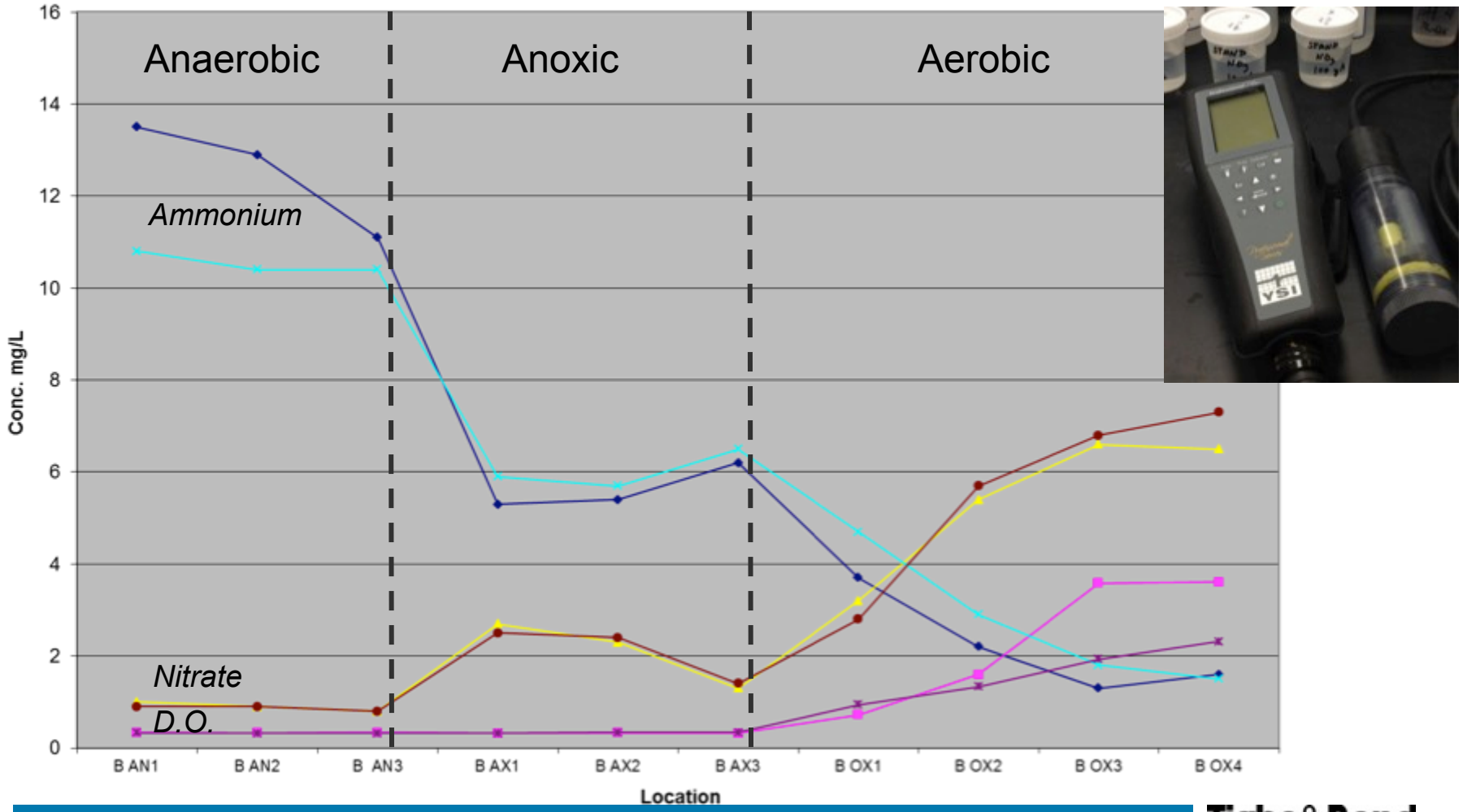
  SOLITAX Analyzer

  – Tertiary Filter Effluent
  – Show clarity
  – Air entrapment issues from filter backwash
  – Minimal maintenance

Equipment Maintenance

- Clean probes weekly
  - Cloth, brush and distilled water
- Calibration corrections as needed
- 2 person job
  - Lifting probes out of tanks

YSI ProPlus Quatro Handheld Probe – NH_4, NO_3, DO, Temperature



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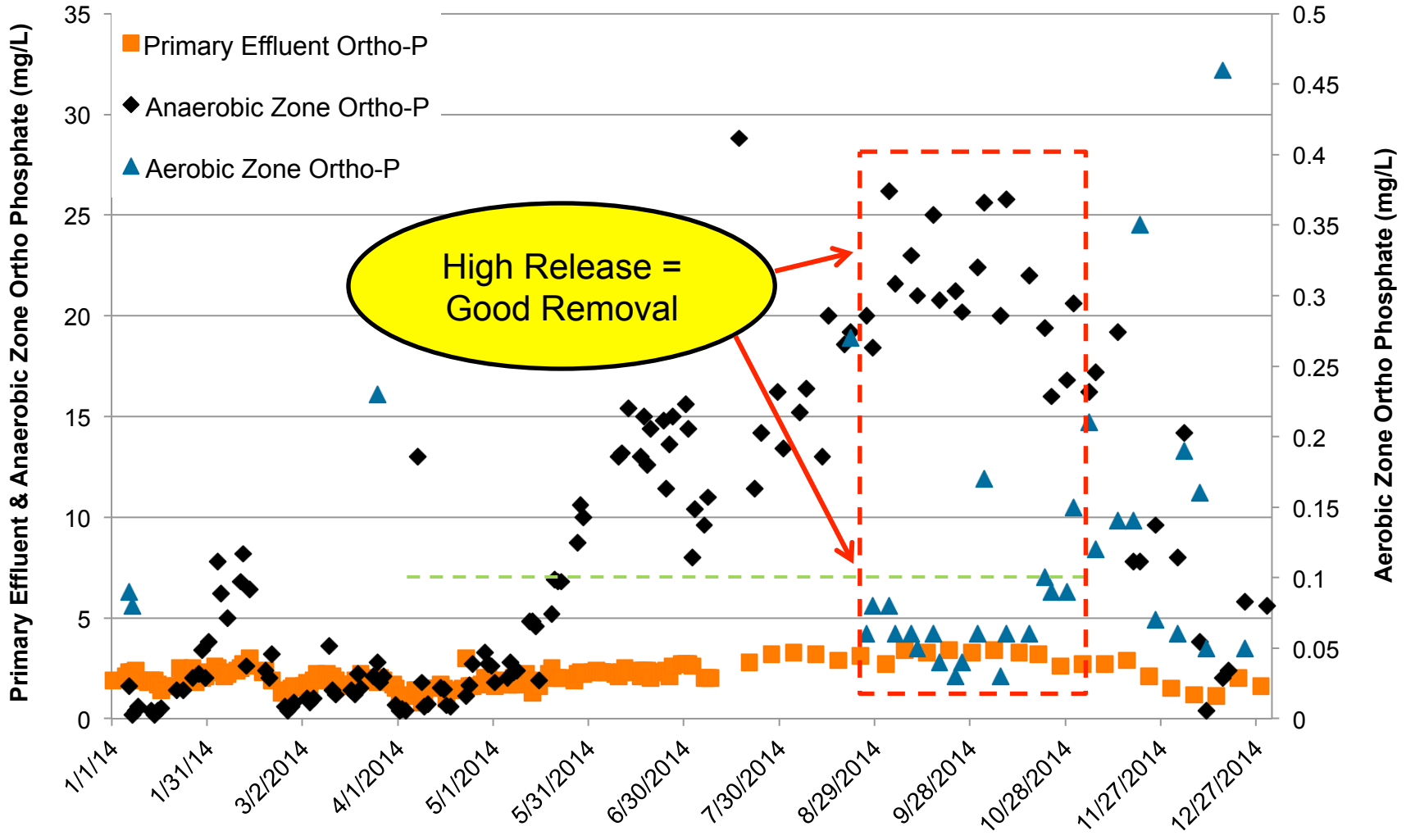
Laboratory Equipment and Testing – In-House

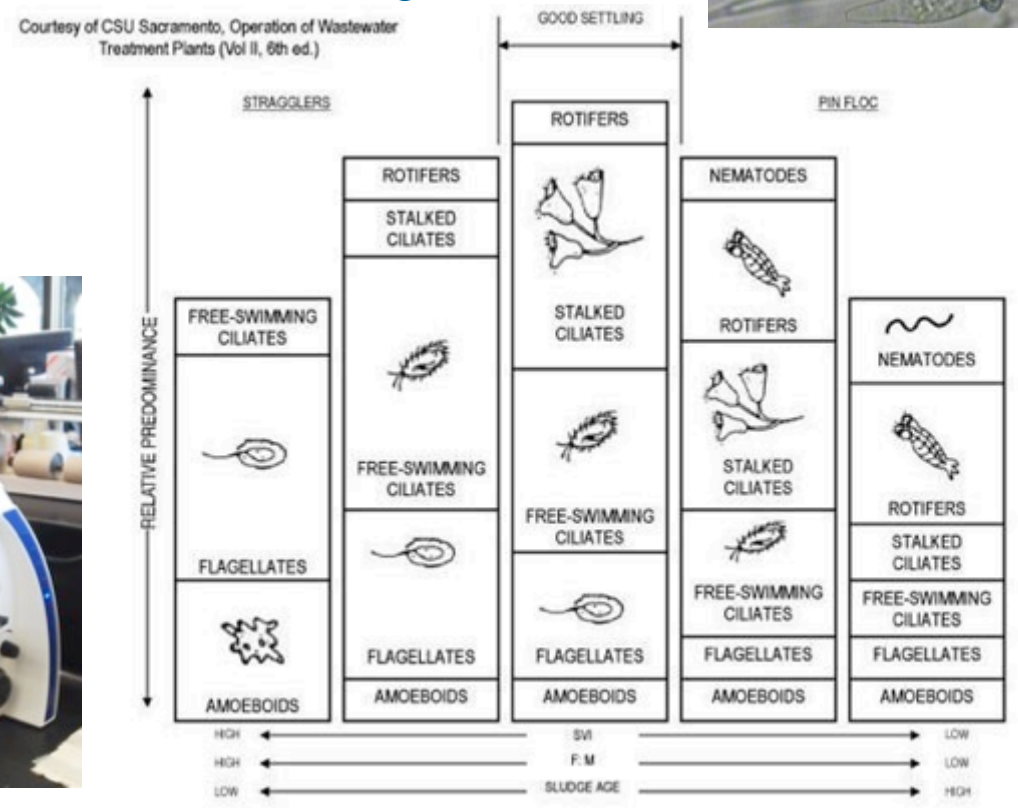
- **Testing for Process Monitoring / Control**
  - Spectrophotometer – Hach DR3900
    - Ortho-P as P - *Ascorbic Acid Method (#8048)*
    - Nitrate - *TNT 835 Low Range*
    - Ammonia - *Salicylate Method (#8155)*
- **What's Important**
  - Reliability, time, cost
  - Make immediate operational changes
  - Anticipating 3rd party reportable test results

Laboratory Equipment and Testing-
Monitoring Phosphorus Removal



Laboratory Equipment and Testing- In-house

- Microbiology for process monitoring
- Microorganisms are indicative of sludge health
- Interested in predominance of the following:
  - Rotifers
  - Stalked Ciliates
  - Free-Swimming Ciliates
  - Flagellates



Lessons Learned & Recommendations

- Every plant is different
- No substitute for an Operator's intuition
- Evaluate the appropriate level of instrumentation for each project

Thank You

- **A Special Thanks to**
  - Merrill Hastings - North Attleborough WWTF Chief Operator
  - Jack Horton – Retired North Attleborough WWTF Chief Operator
  - Val Flaherty - North Attleborough WWTF Assistant Chief Operator
  - Sue Mallon - North Attleborough WWTF Laboratory Technician
  - Sue Guswa - Tighe & Bond

Associated Equipment Maintenance & Operational Costs

Do not show slide, keep for questions reference

	Test	Calibration & Maintenance	Required Costs	Other Comments
Nitrate	Handheld	~Calibrate daily	~Replace probe every 6 months ~ $350 ± / probe	~ Aprox 20 - 30 min to calibrate and condition probe
	TNT	~Annual spec calibration ~No daily maintenance	~ $38.50 / box of 25 vials ~ 6 tests / week = $480 / year	~ Glass vials must be disposed of / recycled every test ~ Aprox 5 min / test
	Insitu	~Clean 1x / wk ~Replace profile & seals annually	~ Replace profile, seals, etc ~ Annual service contract ~ Consult Vendor for Price	~ Instant Readings ~ Viewable on SCADA ~ Recorded in WIMS
Ammonia / Ammonium	Handheld	~Calibrate daily	~Replace probe every 6 months ~ $350 ± / probe	~ Aprox 20 - 30 min to calibrate and condition probe
	Pillow Packet	~Annual spec calibration ~No daily maintenance	~ $112 / bags reagent for 100 tests ~ 8-10 tests / week = $465 to $582 / year	~ Corrosive final solution ~ Aprox 20 min / test once sample settled
	Insitu	~Clean 1x / wk ~Matrix correct 1x/ month ~Replace cartridge every 6 Months	~ Replace cartridge every 6 months ~ $750 +/- consult vendor	~ Readings are instant ~ Viewable on SCADA ~ Recorded in WIMS
Phosphorous	Pillow Packet	~Annual spec calibration ~No daily maintenance	~ $31.29 / bag, 100 tests ~ 15-20 tests / week = $244 to $325 / year	~ Aprox 5 min / test