Environment Canada Environnement Canada

Canada

Quality Assurance and Quality Control of Real-Time Measurements – Update from June 2007

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Environment Canada – Moncton, NB
Real-Time Water Quality Monitoring Workshop
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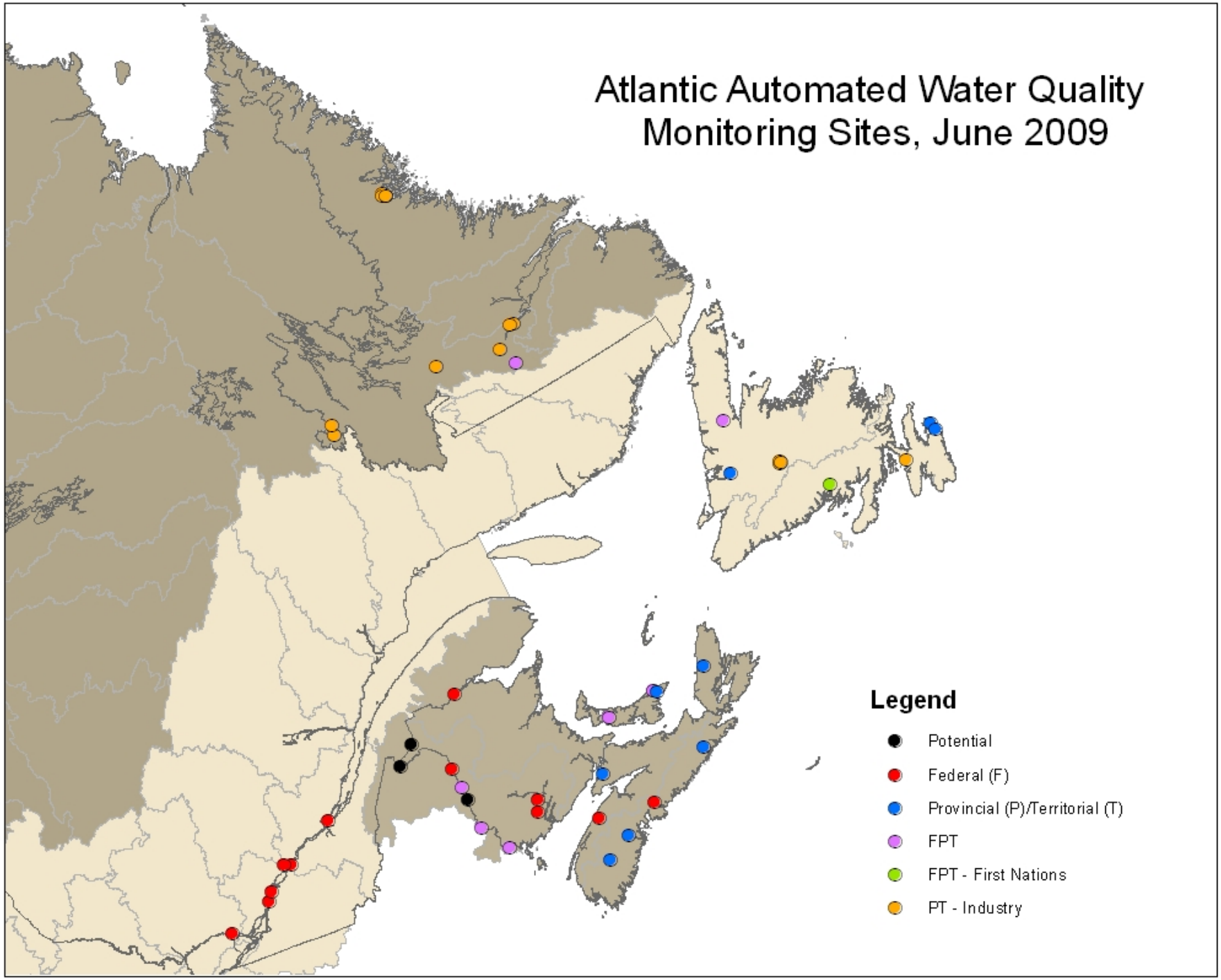
Outline

- Introduction
  - Update on Atlantic Canada Real-time Network
- Why QAQC?
- Update from June 2007
- Examples of Correcting Data for Drift/Fouling
- Future Directions
- Examples of recent work

Introduction

- Atlantic Canada EC perspective only
- Talk is an update from the June 2007 talk on QAQC
- Working closely with our partners to share workload/resources
  - PEI DOE have taken on the work
  - NB DOE is always in the field with EC
  - NL DOE does calibration/maintenance for 2 EC probes
  - In NS, we are looking at getting NGOs to help out with calibration and maintenance


Atlantic Automated Water Quality Monitoring Sites, June 2009
Legend
Potential
Federal (F)
Provincial (P)/Territorial (T)
FPT
FPT - First Nations
PT - Industry

Why QAQC?

- QAQC should be an integral part of a project – planning, designing, field work, lab analysis, data evaluation, reporting.
- Good QAQC will:
  - minimize errors in your program
  - raise scientific credibility of your data
  - avoid wasting $ on data of unknown quality
  - cost $
  - promote consistency and comparability across networks and enable interoperability of data for consolidated use

- ***"Always keep in mind that it's better to have a few reliable data points than many unreliable ones!" – Fundamentals of Environmental Sampling and Analysis 2007***

Quality Assurance/Quality Control (QAQC) – slide from June 2007

- Field QAQC
  - All probes are calibrated using same method – draft document
    - Modified draft document for step by step calibration
  - Calibrating solutions are either purchased or prepared in house (EC Moncton lab)
  - Calibration results entered into standardized spreadsheet
    - Modified spreadsheet to track detailed pre/post readings
  - Measurements taken with second meter prior to removing probe from river and again prior to re-deploying into river
    - Added pre/post cleaning measurement in field
  - Real-time data is corrected for drift/fouling
  - All field visits, maintenance work, sensor changes are tracked in a database

How to Evaluate Drift/Fouling?

- In 2007, we were using 2 methods:
  - Comparing with recently calibrated field meter during removal/deployment
  - Taking pre/post cleaning measurements with the deployed meter at the hotel/laboratory
- With increased experience, we started noticing problems with the pre/post cleaning method

Pre/Post Cleaning Issues

- After taking readings with field meter, we would fill the calibration cup with water and bring deployed meter to hotel
  - Water moving around would essentially ‘clean’ the probe before we could get pre/post readings with standards
- Started only adding a few mL of water in calibration cup to maintain a ‘moist’ atmosphere
  - but noticed that the ‘algae/biofilm’ would tend to dry during transit and fall off thereby giving wrong data for the pre/post clean readings…
- Now what?

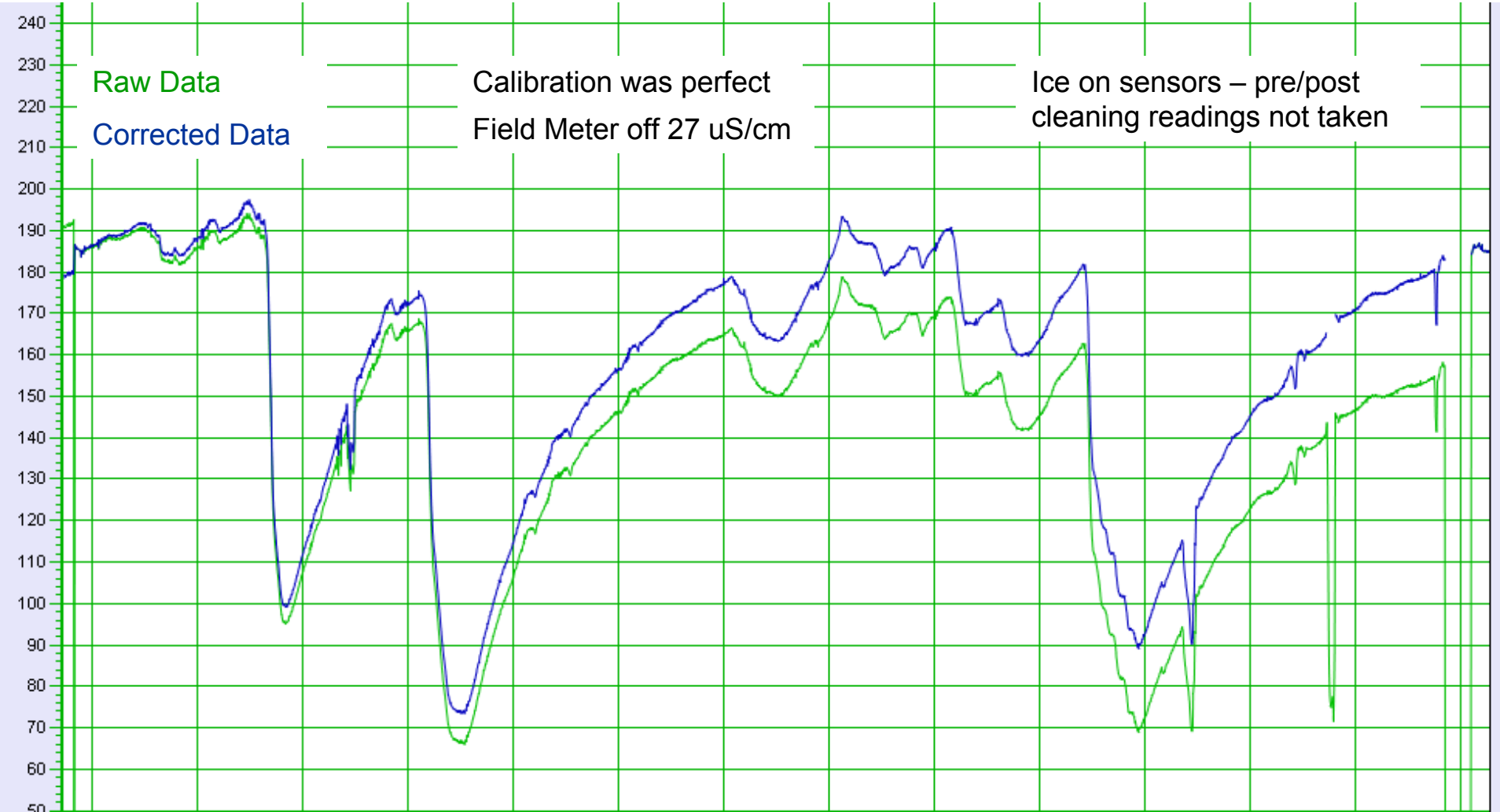
Pre/Post Cleaning Readings

- Since 2008, we do a preliminary cleaning in the field using toothbrush and paper towel to get an idea of the fouling's effect on the readings… Seems to work well but hard to compare with previous way to assess fouling.

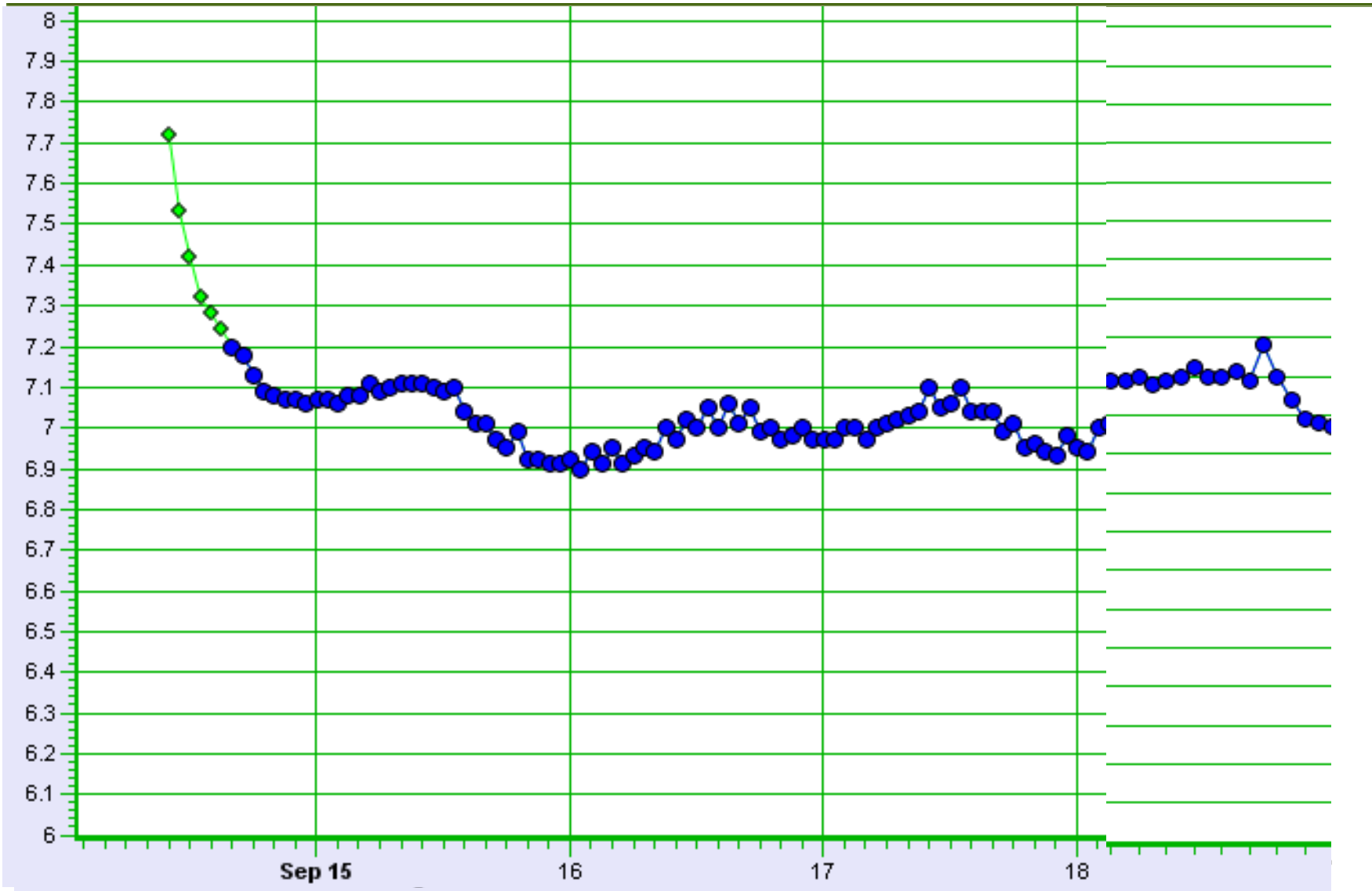
We also now put a pantyhose over the sensor guard when we deploy the probe at locations where bio-fouling is a known issue**

**This can affect Turbidity readings so use with caution.

Specific Conductance at Bear River, PEI from Feb 2008 to March 2008



Funny what you notice when you pay attention…



Funny what you notice when you pay attention…

- Slow stabilization is not limited to the meter that will be deployed, it could also be present with the field meter
- If you only base your corrections on comparing with field meter, this could pose a problem.

Quality Assurance/Quality Control (QAQC) from June 2007

- Drift Correction:
  - As our exp increases, the difference between using another field meter and taking pre/post cleaning measurements is decreasing for all parameters
    - We are getting more consistent for sure
    - We now know that algae/bugs fouling needs to be assessed at time of removal
  - Data using two methods doesn't always agree
    - This will likely always be the case for several reasons. I.e. temperature equilibration, bad calibration, old versus new sensor, operator error
  - No way to predict when two methods will/won't agree
    - We now have some idea when they will agree: good calibrations for both meters, fairly new sensors on both meters, same type of sensor on both meters, reasonable weather conditions

Quality Assurance/Quality Control (QAQC) from June 2007 – cont.

- Which method works best?
  - Depends on several variables (temperature, river type, parameter measured, time of year)
  - Very useful to have both sets of results to compare
    - Still true
  - At this point, we are still evaluating both methods and would not want to pick one over the other
    - We are past evaluating stage and now as part of our procedures, we always record both sets of measurements
  - Documentation is critical to evaluating drift
    - Still true
  - Data from re-deployment is very important in deciding if/how to apply drift correction

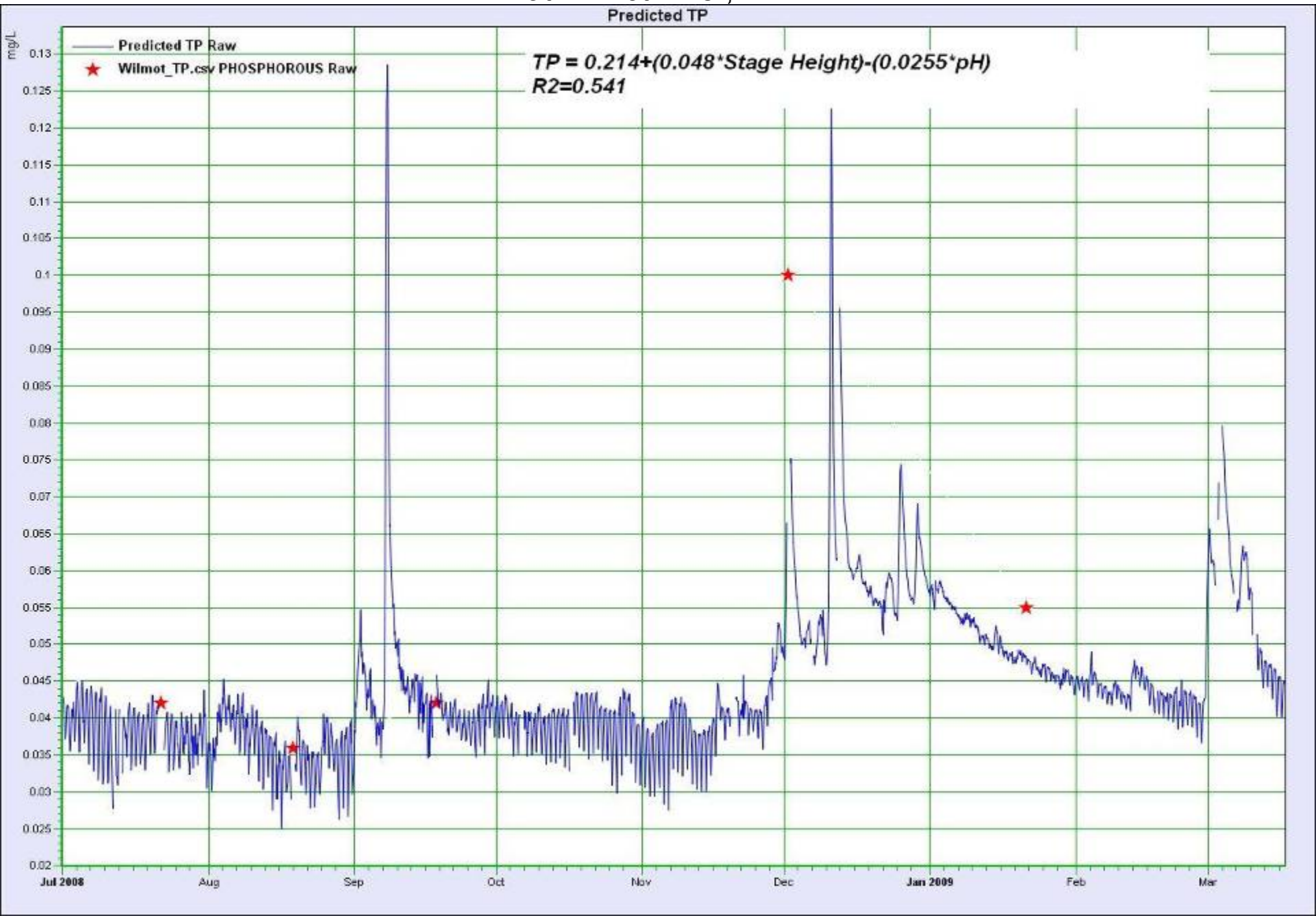
Future Directions – 2007 (2009)

- Continue using both drift measurement methods
  - EC will continue with both sets of measurements
- Real-time network for EC Atlantic will likely stay at current size for near term
  - EC will opportunistically increase network by working with partners – Provinces, Federal Dept., NGOs
- Focus on improving and documenting all our protocols to ensure consistent data of high quality is reported
  - Very important to EC. Documents are in various stages of DRAFT and EC Atlantic part of the national effort to have a real-time protocol
- Continue work within EC to have a database for storing raw and corrected real-time data
  - Significant progress on this point. Raw data is stored in our database. Not easy to build bridge to accept corrected data.
- Near real-time web reporting to the public (internal only at present)
  - Still internal only although we have improved the format

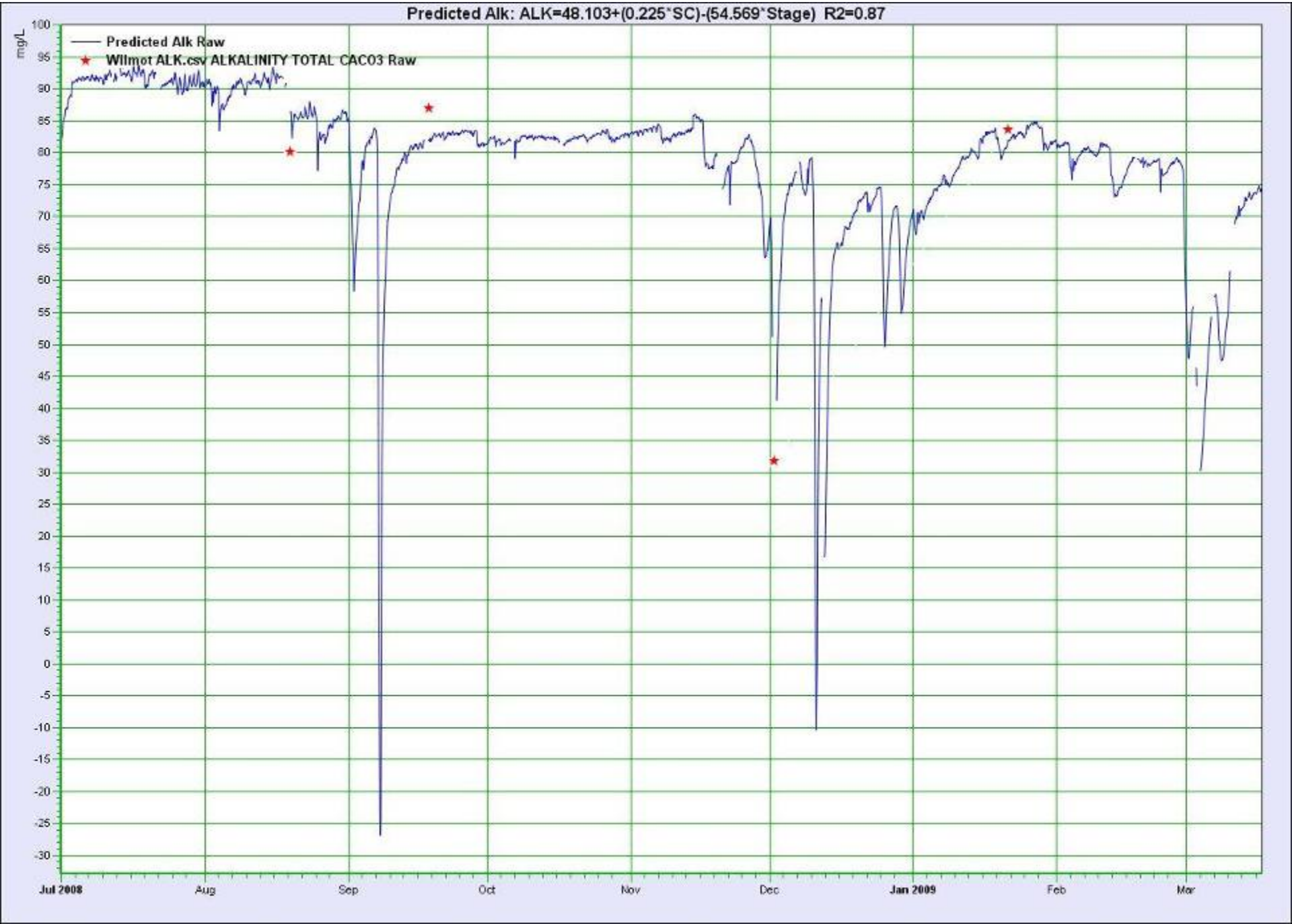
Future Directions – 2007 (2009)

- Evaluate software to process/correct real-time data automatically
  - Based on experience, we don't see this happening because there are too many variables to consider before correcting data. We are focussing more on trying to standardize when we correct data so that it's consistent across offices
- Continue our partnership with Provinces to share knowledge and experiences with real-time monitoring challenges, and to combine our financial and human resources towards generating real-time water quality data of high quality that will be useful for the public, industry, and the decision makers
  - Still very true and we are expanding our partnership to other Federal Departments and NGOs
- Start using QAQC information to make our programs more pro-active rather than reactive
  - pH sensor response time
  - When does fouling occur
  - When do we need to correct for drift – seasonal, station specific, parameter specific?

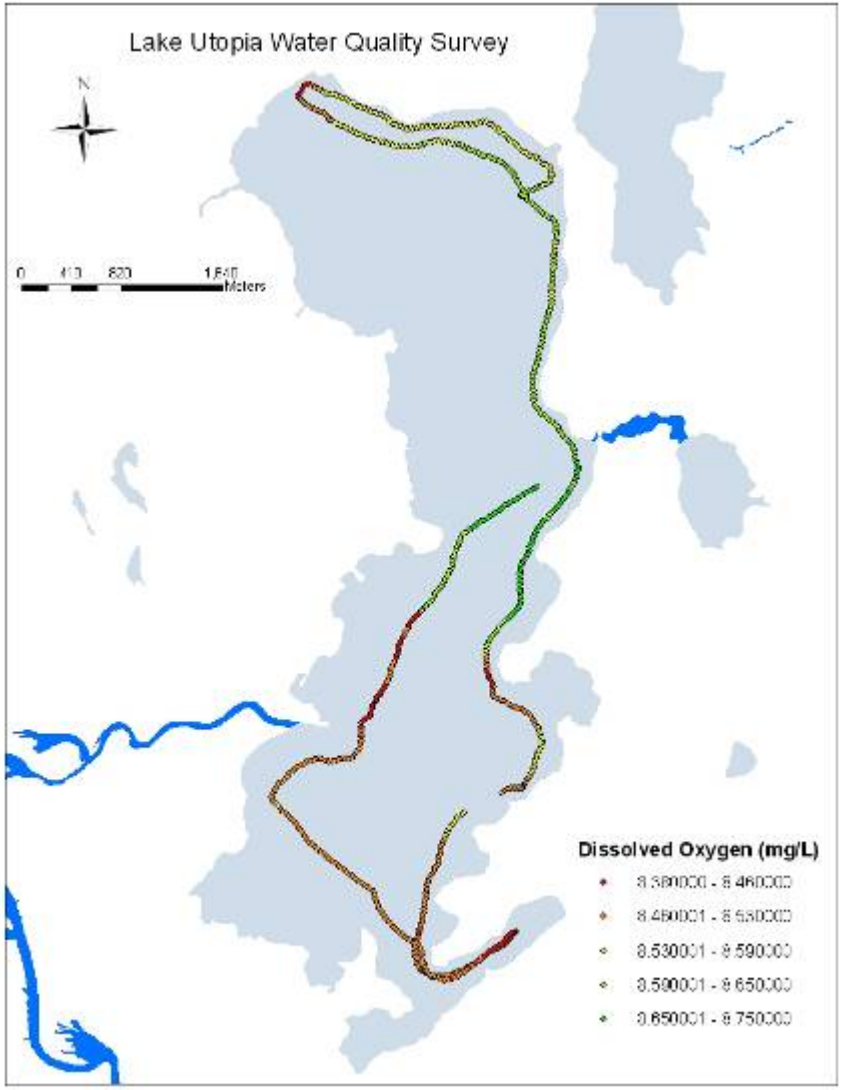
Predicted Total Phosphorous Concentration using water elevation and real-time pH measurements at Wilmot River, PEI



Predicted Alkalinity Concentration using water elevation and real-time pH measurements at Wilmot River, PEI



Using Real-Time Technology for Surveys



Thank you – Questions?

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