



locating human sewage sources in a small urban stream using temperature/conductivity dataloggers

A cooperative study by

Seattle Public Utilities

and

*King County Department of Natural
Resources and Parks*

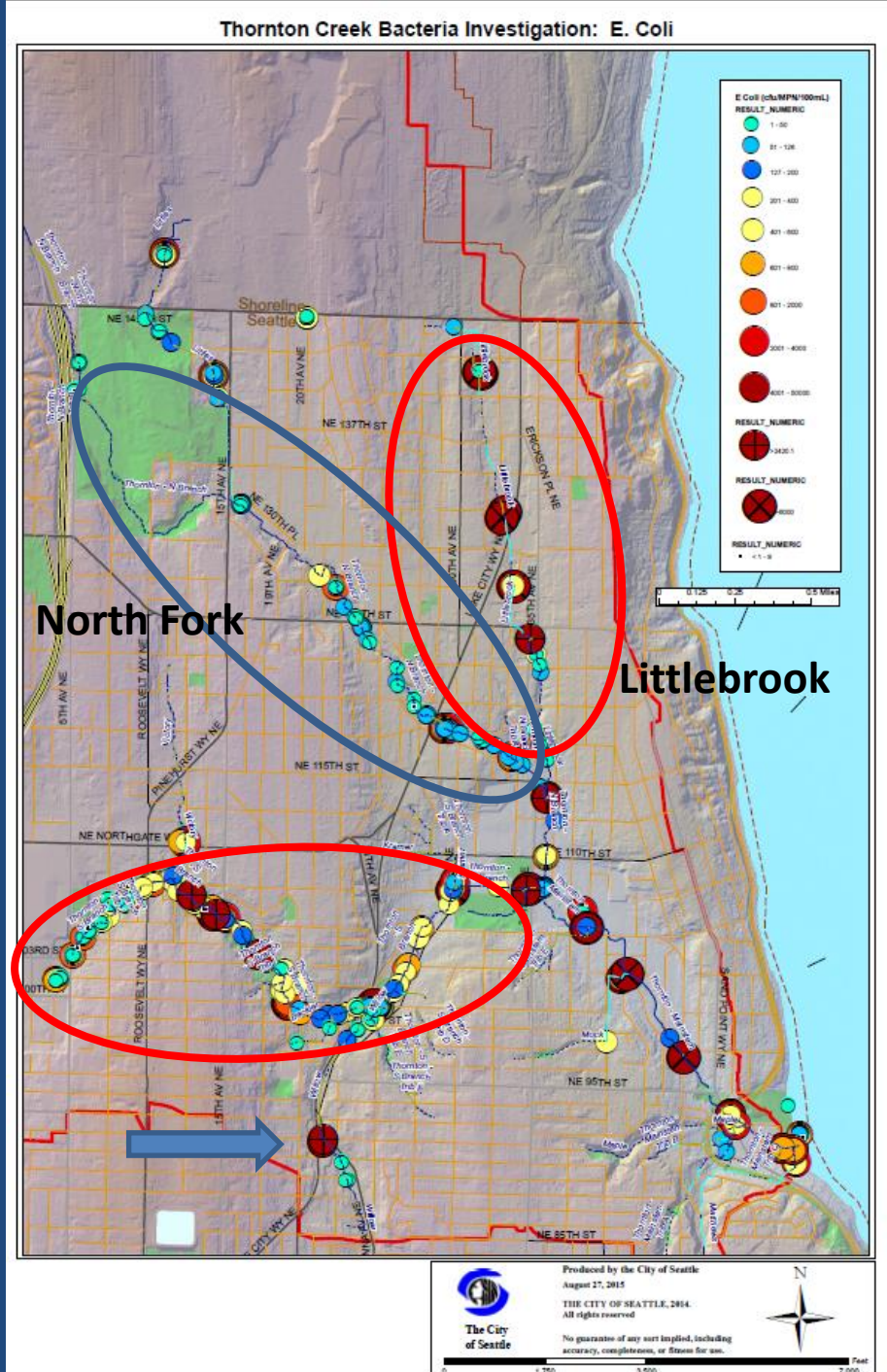
Jonathan Frodge
Limnologist
Seattle Public Utilities

E.Coli is a better indicator of human source bacteria than fecal coliform and is used in the Thornton Creek Bacteria Investigation (TCBI)

fecal coliform is the regulated indicator in Washington (WAC173-201A)

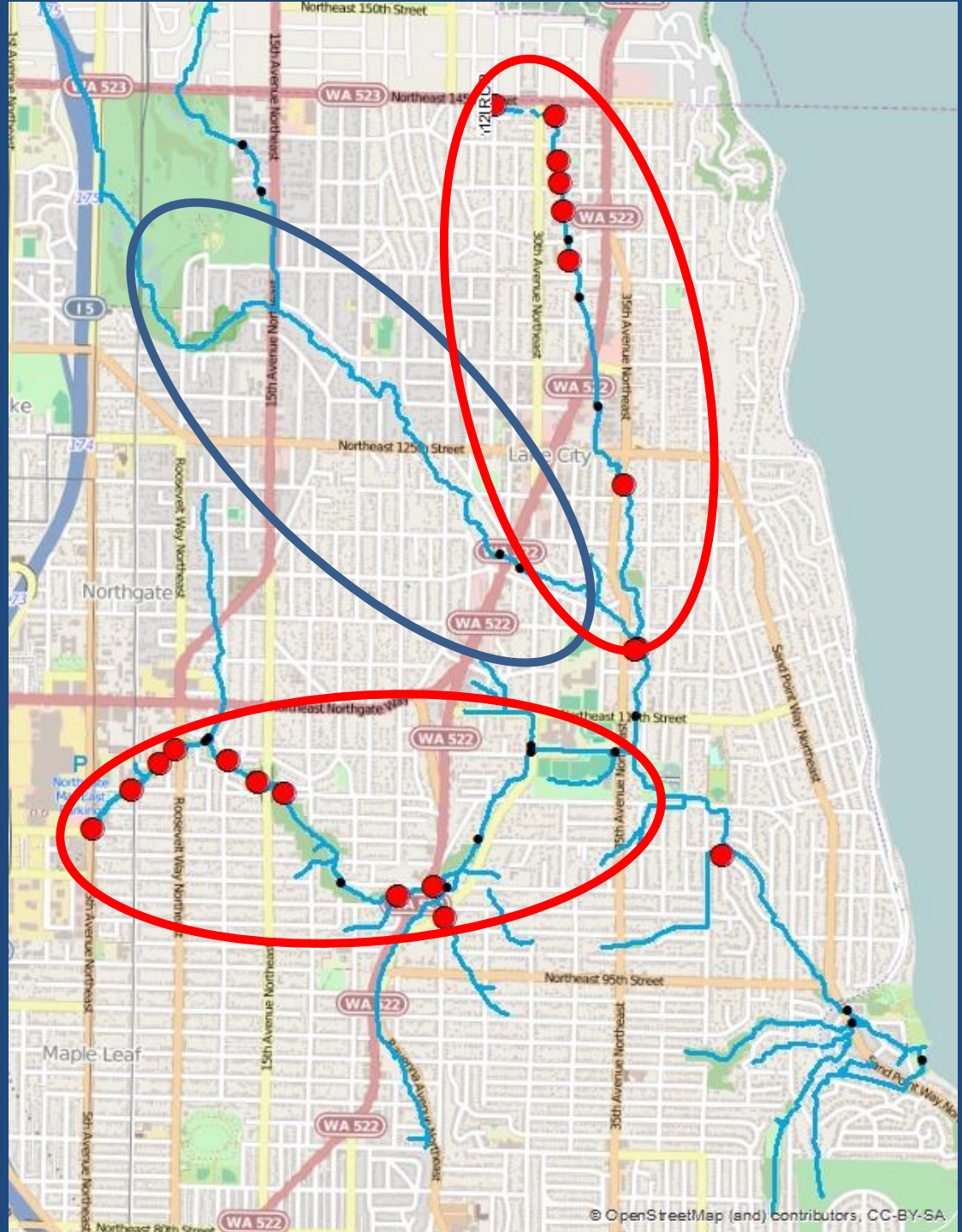
South Fork

Willow Creek cross connection



locations where
temperature/conductivity
data loggers have been
deployed

currently we have
only ten
dataloggers, so we
need to shift
resources

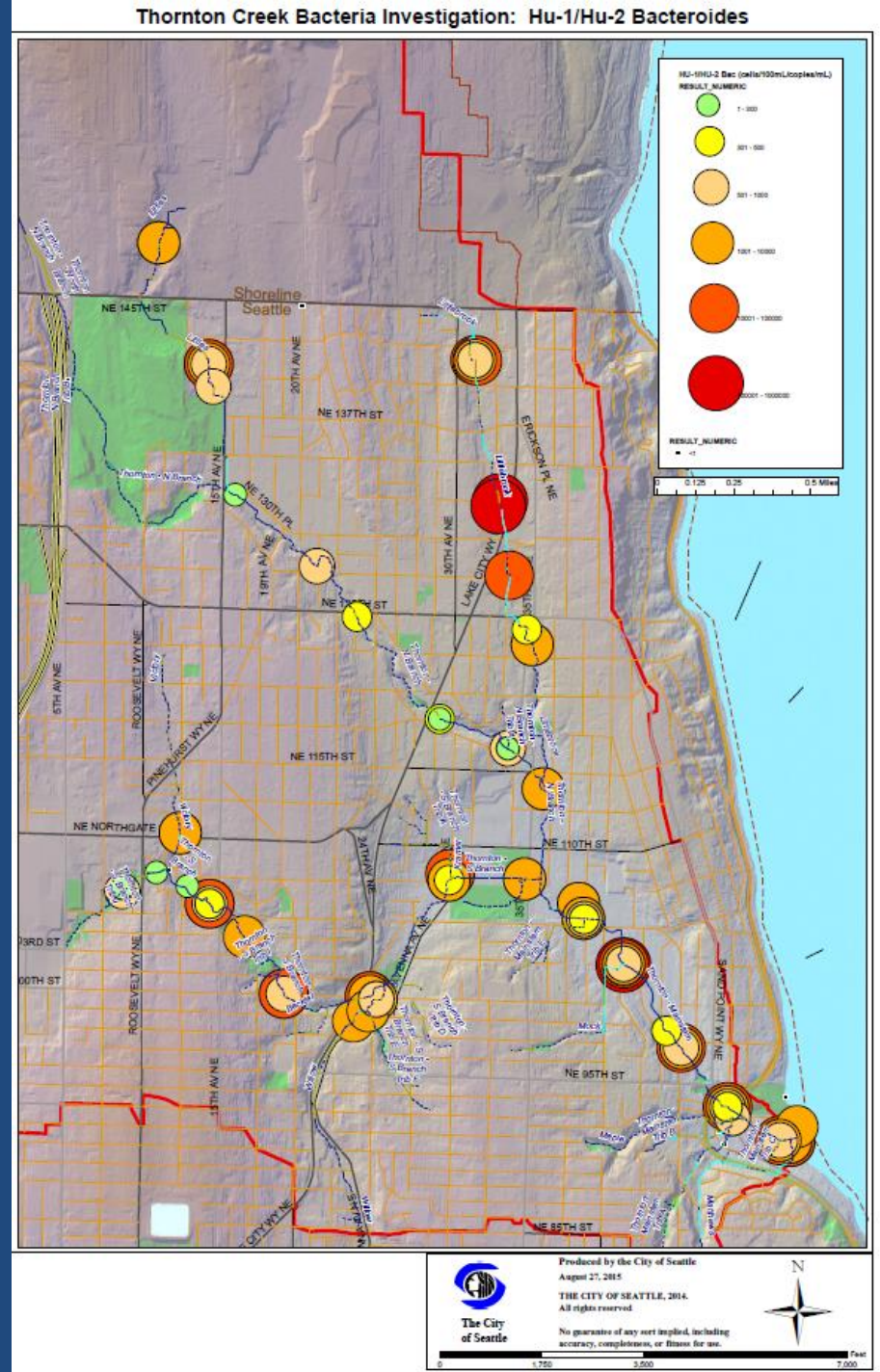


Hu-1 and Hu-2 Bac uses analytical techniques cooperatively developed by *King County Environmental Laboratory* and *EPA*

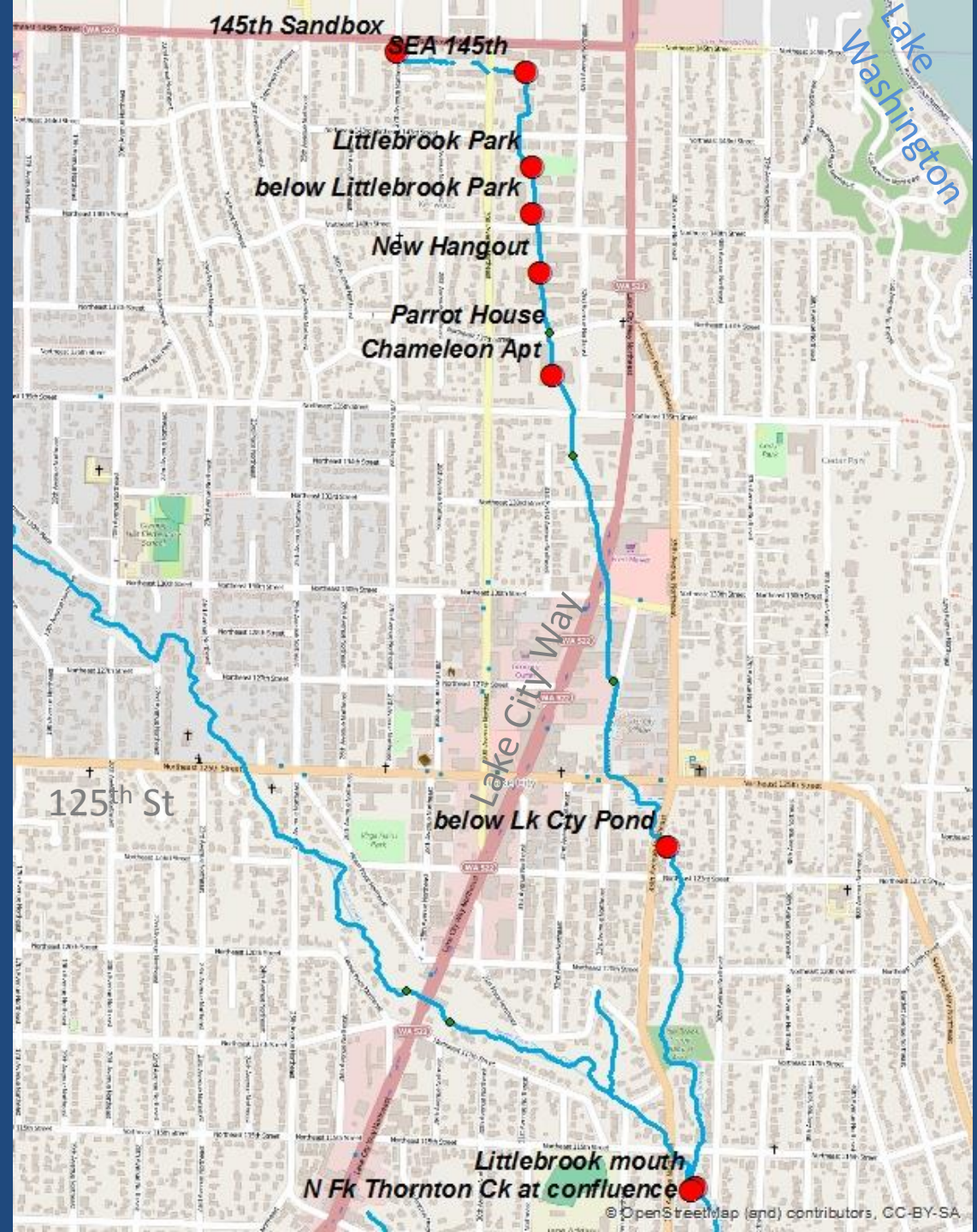
this microbiological analysis quantifies human-specific *Bacteroides thetaiotamicron*

high counts of this bacteria is used to confirm human source bacteria (fecal material)

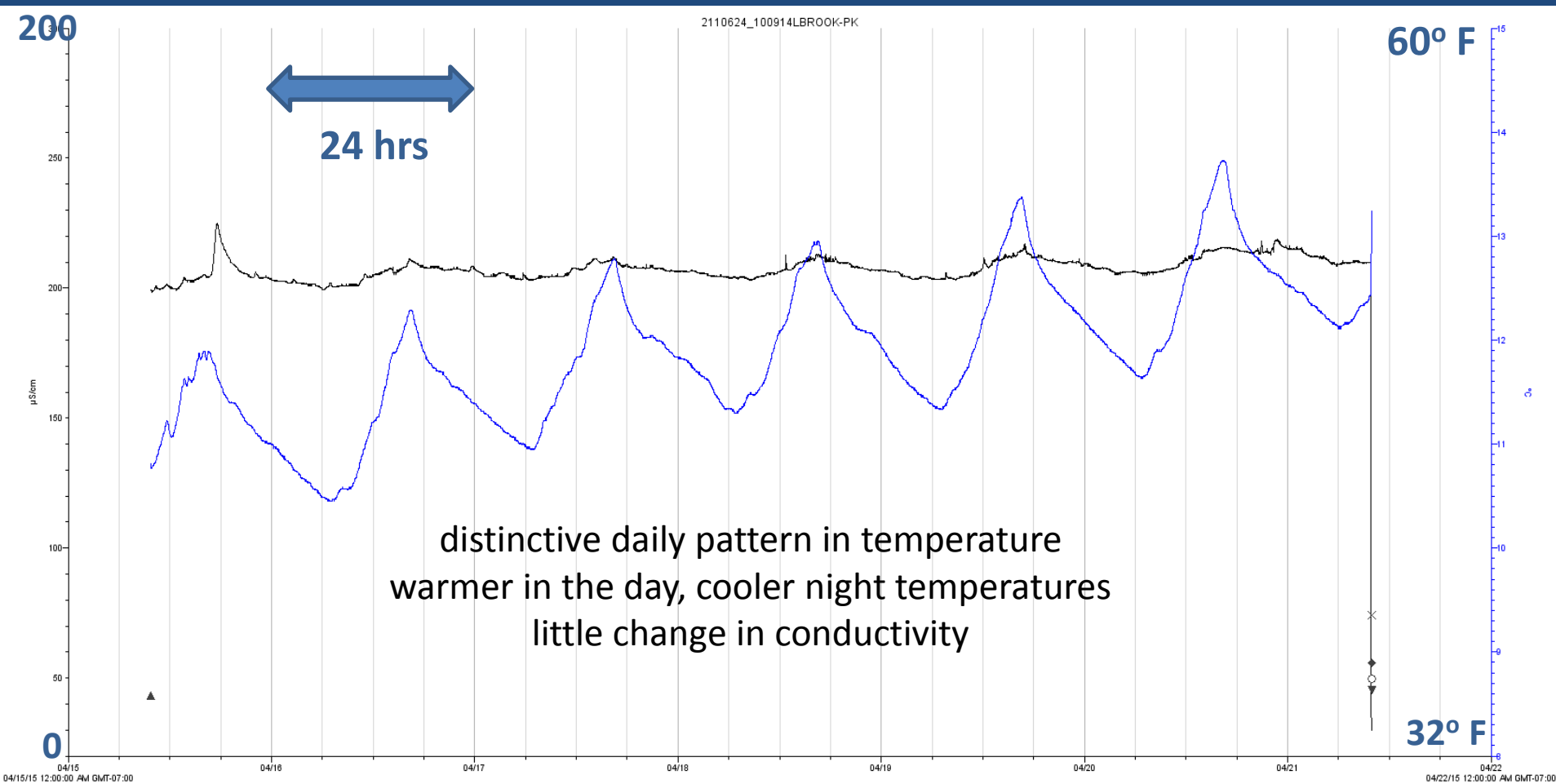
increased public health risk



initial datalogger deployment locations in Littlebrook Creek

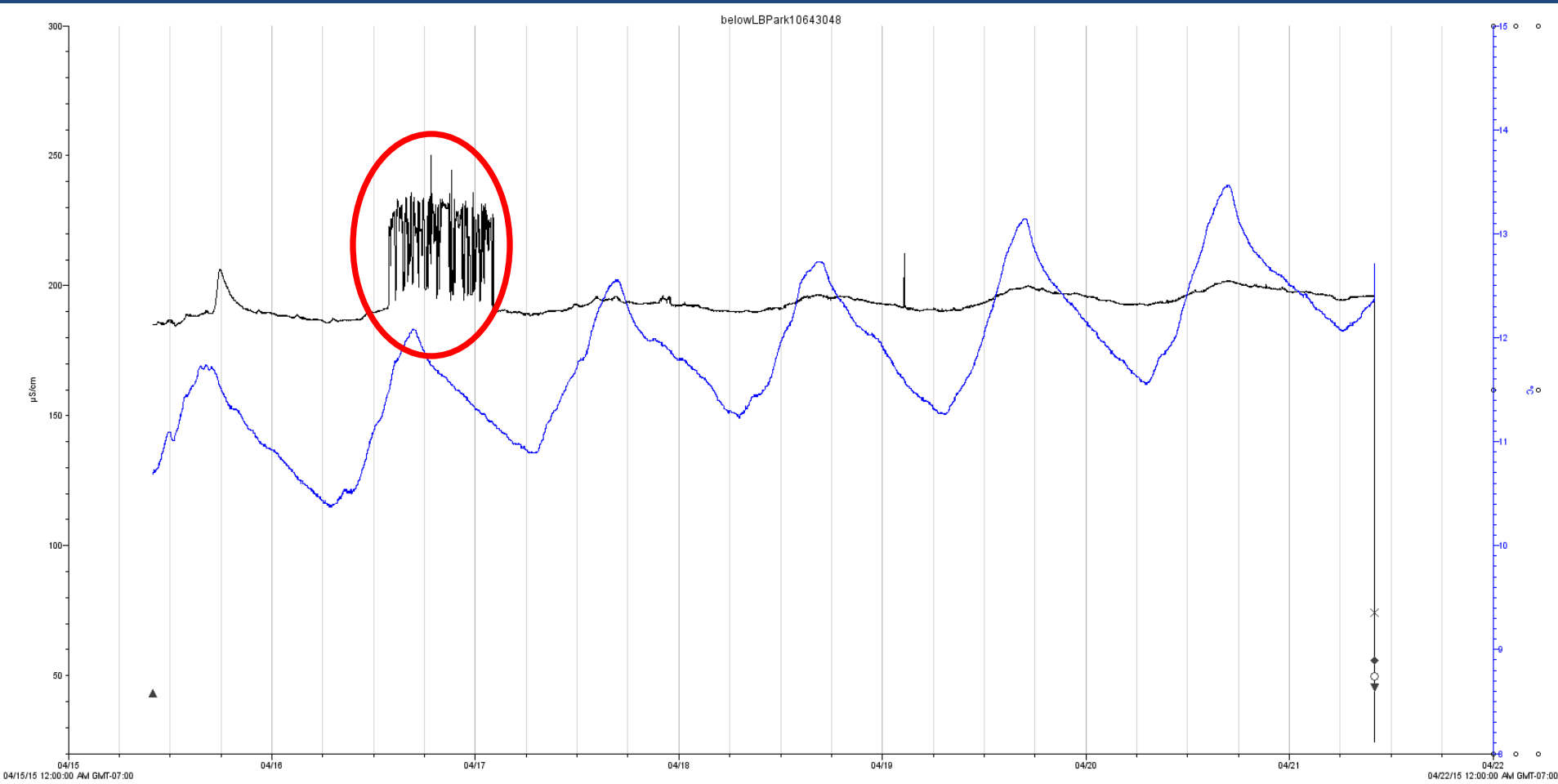


Littlebrook Park

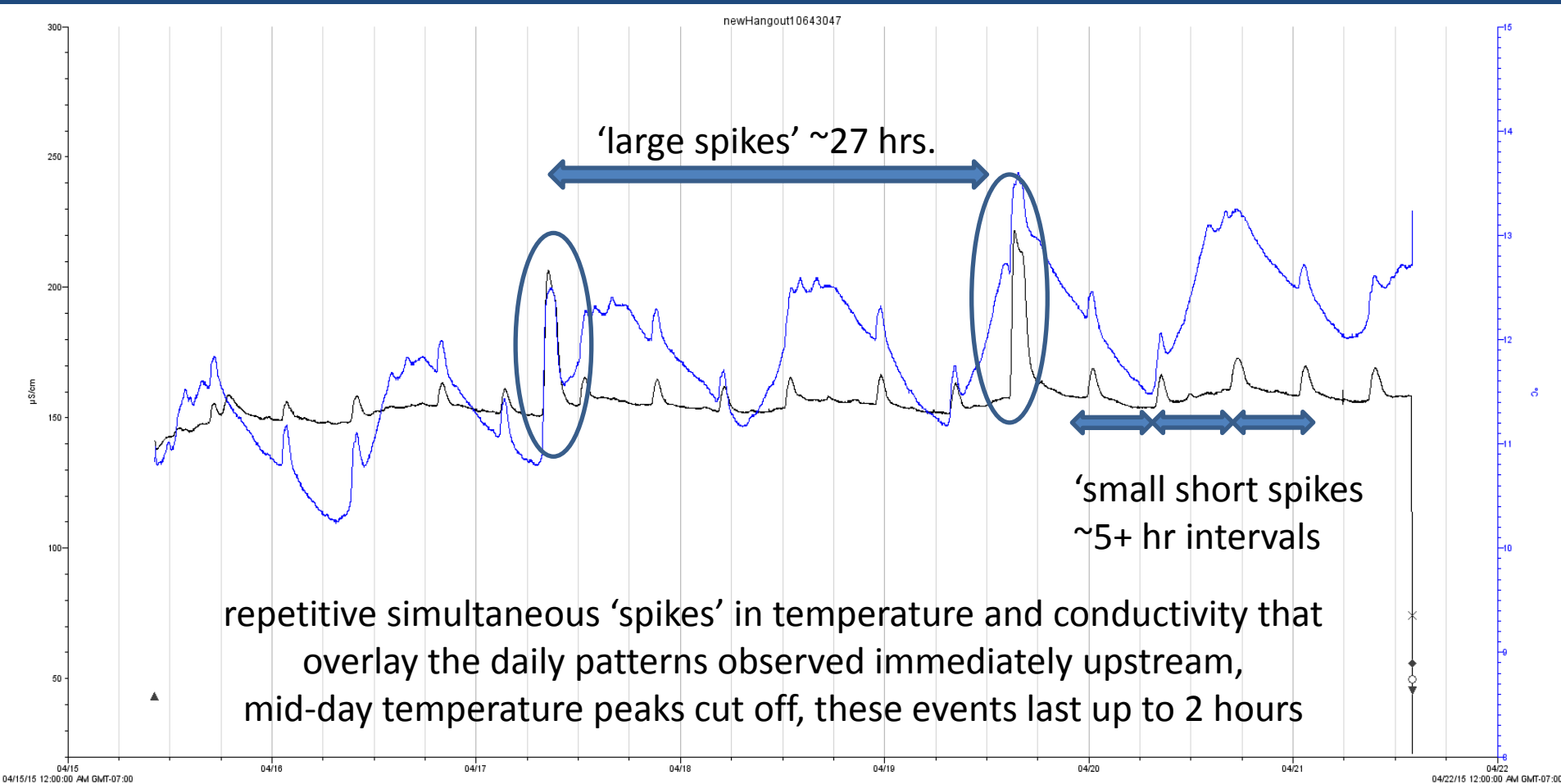


sewage is warmer (in winter) and has higher dissolved ions,
and therefore conductivity, than creek water

below Littlebrook Park



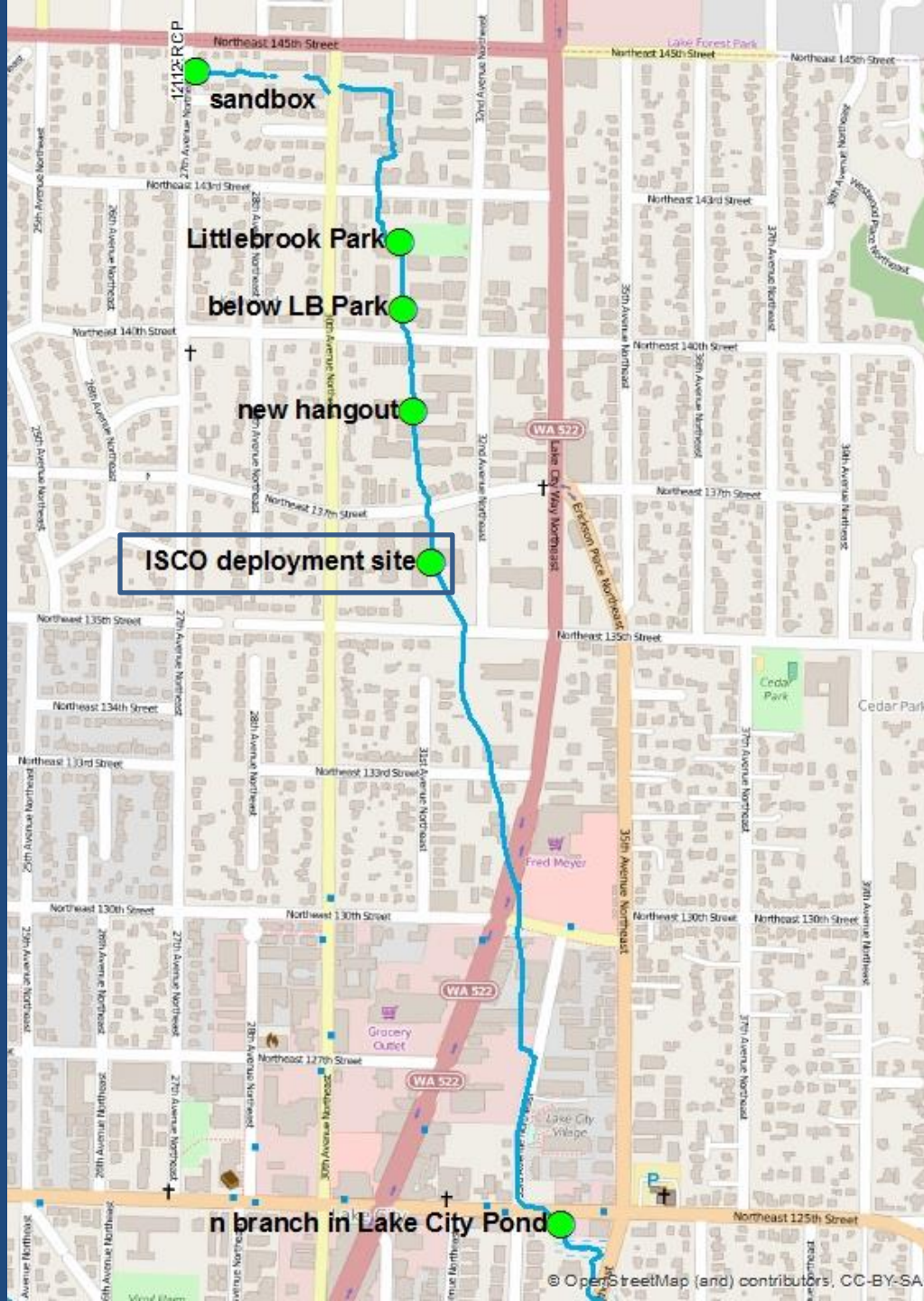
6 hour event- increased conductivity no apparent effect on temperature - cause?



these ‘spikes’ or simultaneous repetitive temperature/conductivity anomalies are the signal we are looking for to identify unknown discharges into the creek

The ISCO sampler collects a composite sample (partial samples every 15 minutes) every hour for 24 hours between 11AM April 29 and noon April 30, 2015

these other sites were sampled during the early part of the ISCO deployment (11 AM – 4PM) as reference sites





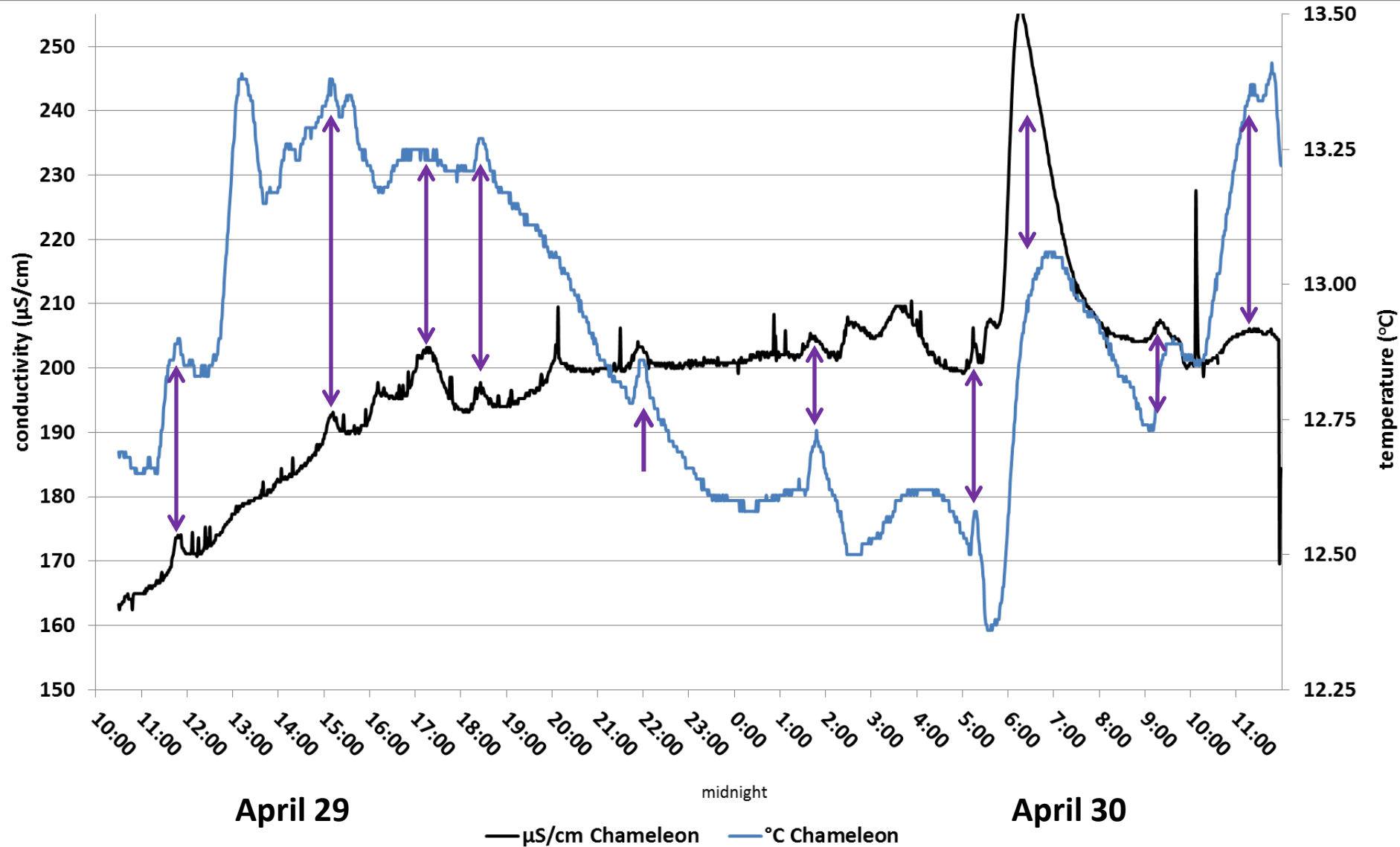
24 1 hour
composite
samples
analyzed for
E. coli and
Bacteroides



water collection tube, located in
same sampling block with
temperature

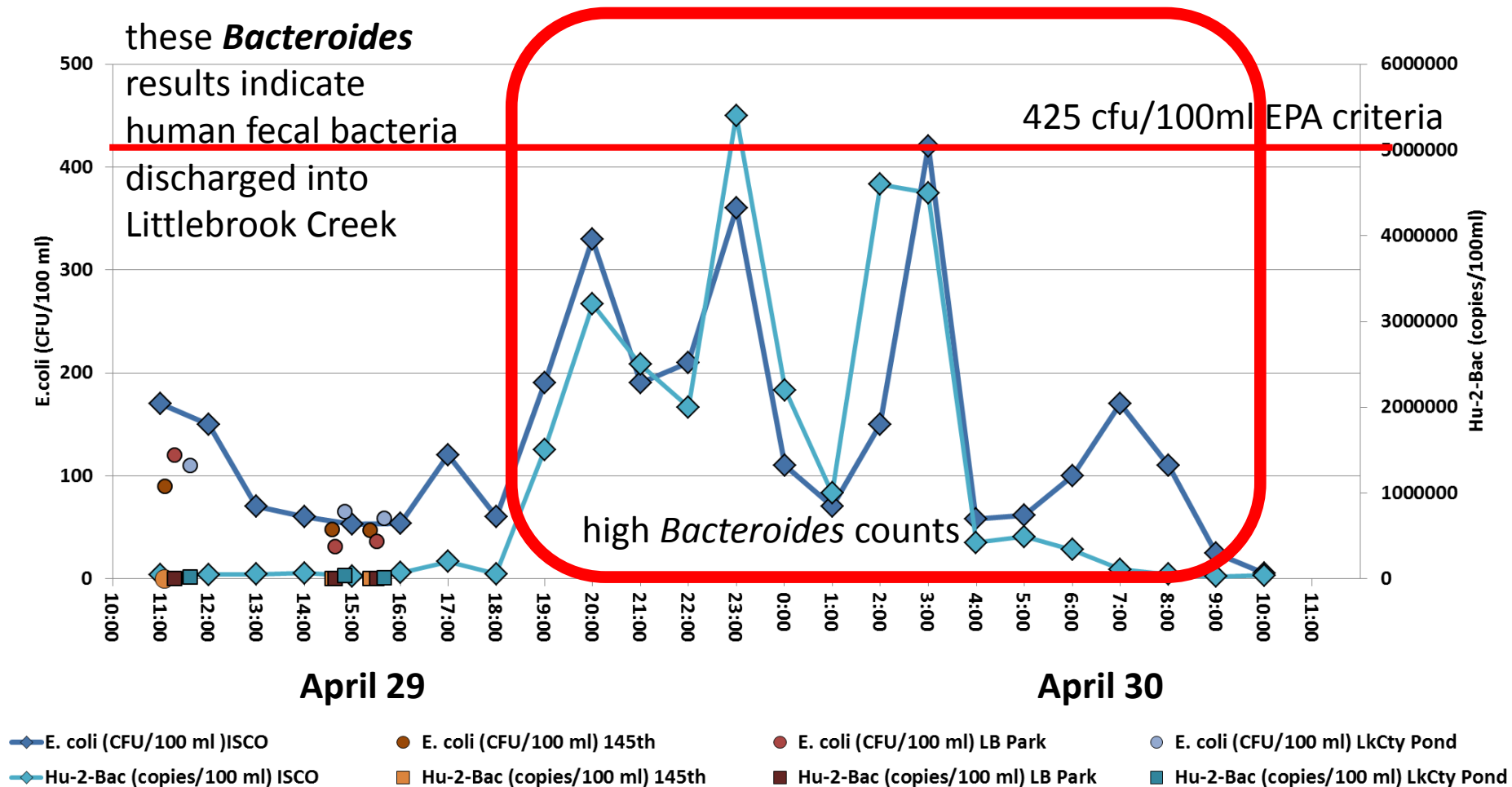


24 hours

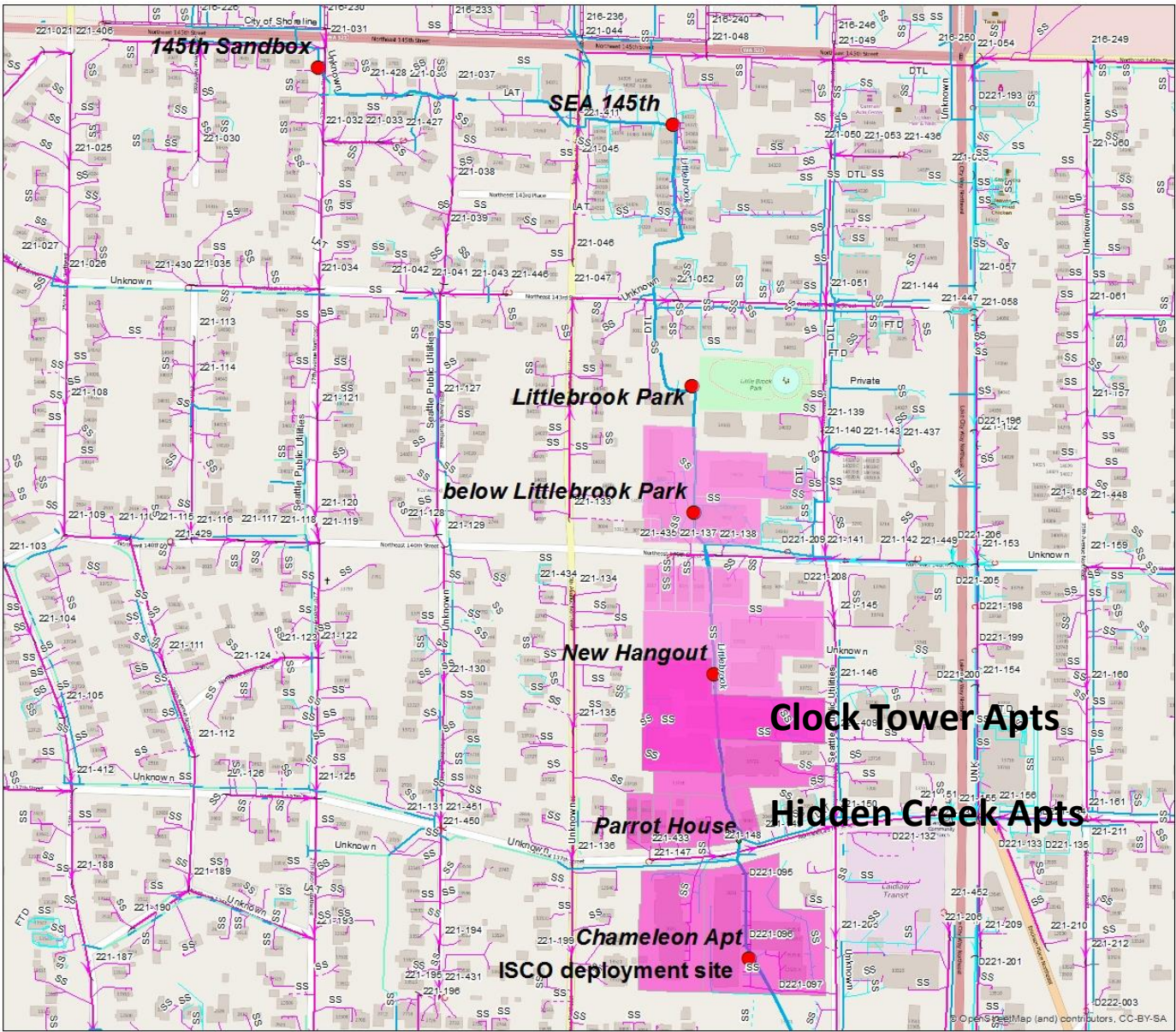


temperature – conductivity data for the same period as the ISCO deployment and bacteria sampling

hourly composite *E. coli* and *Bacteroides* bacteria results



ODEQ and EPA recommended *E. coli* criteria (425 cfu/100ml)

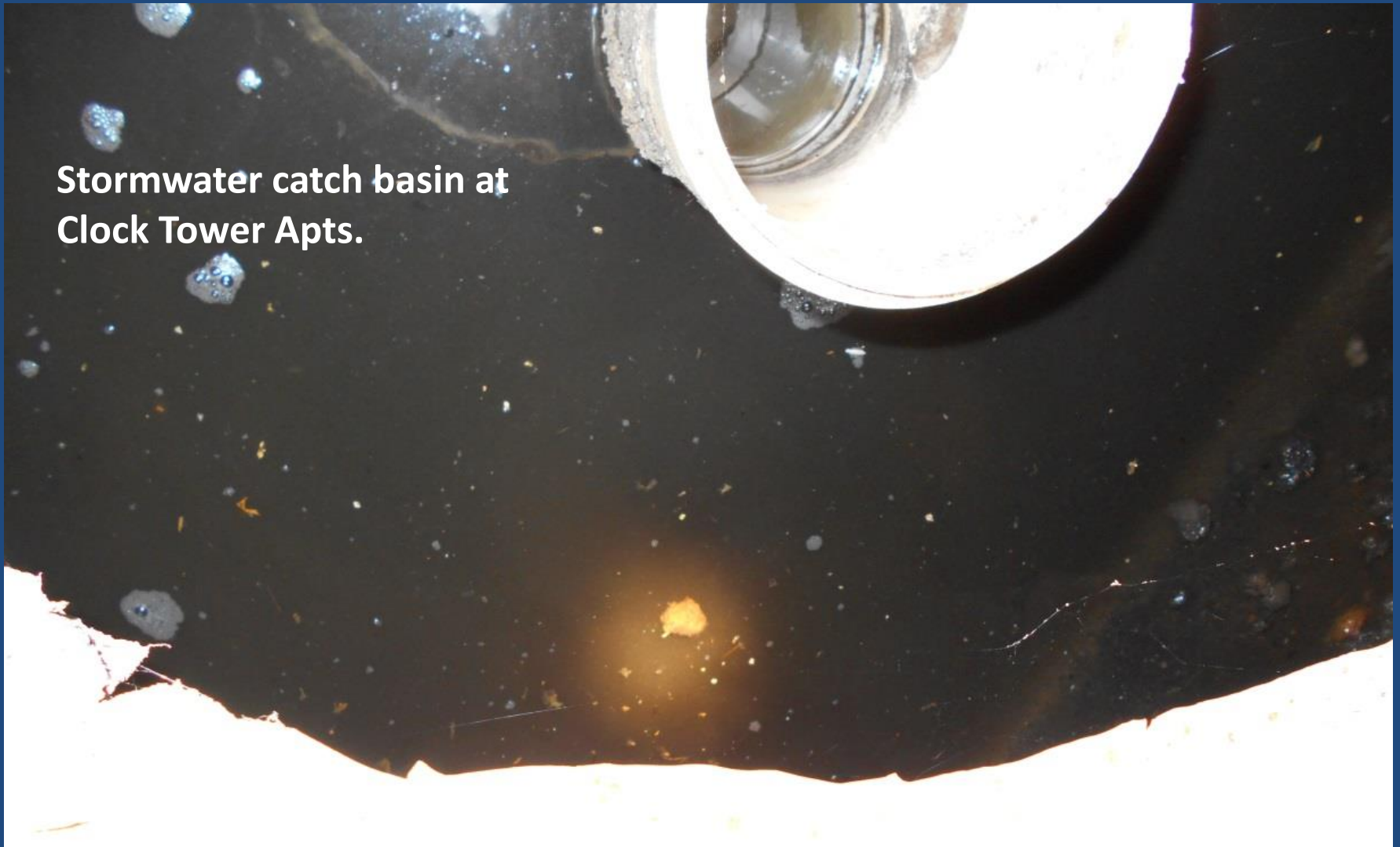


Legend
thermistor deployment site

- thermistor deployment site
- suspect_parcels
- ThorntonCreek
- Culvert
- Ditch
- SPU Drainage Main
- SPU Sanitary Main
- SPU Combined Main
- King County Drainage Main
- King County Sewer Main
- Private Drainage Main
- Private Sanitary Main
- Private Combined Main



**Stormwater catch basin at
Clock Tower Apts.**



Stormwater catch basin at Clock Tower Apts





**Clock Tower Apts.
stormwater
detention vault**

**dye-test confirms
direct discharge
from toilets to
stormwater
detention vault**



Department of Ecology - Environmental Report Tracking System

ERTS # 658594

Initial Report

External Reference #

Caller Information

First Last
Name ALEX WOLPOW-GINDI
Business Name SEATTLE PUBLIC UTILITIES
Street Address 700 5TH AVE SUITE 4900
Other Address
City SEATTLE State WA Zip 98124
E-mail alex.wolpow-gindi@seattle.gov Confidential_FL ☐
Phone Ext Type
(206) 255-2044 Business

Where did it happen

Berth Anchorage
Location Name CLOCKTOWER APARTMENTS
Street Address 13725 32ND AVE NE
Other Address
City/Place SEATTLE State WA Zip
County - Region KING NWRO FS ID
WIRA #
Waterway LITTLEBROOK CREEK Type STORM DRAIN
Latitude Longitude
Topo Quad 1:24:000 SEATTLE
Direction/Landmark (mile post, cross roads, township/range)

What happened

Spills Program Oil Spill? N

Incident Date 8/3/2015 Received Date 8/3/2015 13:34
Medium STORM DRAIN PIPE
Material SEWAGE/SLUDGE
Quantity Unit
Source DOMESTIC
Cause OTHER
Activity ROUTINE/NORMAL OPERATIONS
Impact WATER POLLUTION
Vessel Name
Hull Number

Primary Potentially Responsible Party Information

First Last
Name SARAH ALLWORTH
Business Name CLOCKTOWER APARTMENTS, REGIONAL MANAGER
Street Address
Other Address
City State WA Zip
Phone Ext Type
E-mail

Additional Contact Information

Name Phone Ext Type

More Information

REPORT RECEIVED VIA ONLINE SUBMITTAL FORM:

SPU IDDE observed raw sewage in a private stormwater detention system at the Clocktower Apartments (13725 32nd Ave NE). Illicit connection was confirmed via dye-test. This detention system discharges directly to Littlebrook Creek. SPU will work with Clocktower Apartments to have repair made.

ONLINE SUBMITTAL FORM AVAILABLE AT:
X:INWRO ERTS/ERTS Incident Additional Info/2015/658594

Entry Person SACAYANAN, TAMARA

Entry Date 8/5/2015



Hidden Creek Apts.

ERTS # 658143

Initial Report

Caller Information

First Last
Name ROBERT WHITE
Business Name SEATTLE PUBLIC UTILITIES
Street Address 714 CHARLES ST
Other Address
City SEATTLE State WA Zip 98124
E-mail robertj.white@seattle.gov Confidential_FL ☐

Phone Ext Type
(206) 552-5878 Business

External Reference

Where did it happen

Berth Anchorage
Location Name
Street Address 3032 NE 140TH ST
Other Address
City/Place SEATTLE State WA Zip 98125
County - Region KING NWRO FS ID
WIRA #
Waterway Type
Latitude Longitude
Topo Quad 1:24:000 SEATTLE
Direction/Landmark (mile post, cross roads, township/range)

What happened

Spills Program Oil Spill? N

Incident Date 7/14/2015 Received Date 7/14/2015 13:13

Medium BUILDING/STRUCTURE

Material SEWAGE/SLUDGE
Quantity Unit

Source PIPELINE

Cause EQUIPMENT FAILURE

Activity ROUTINE/NORMAL OPERATIONS
Impact HUMAN

Vessel Name

Hull Number

Primary Potentially Responsible Party Information

First Last
Name
Business Name
Street Address 3032 NE 140TH ST
Other Address
City SEATTLE State WA Zip 98125
Phone Ext Type
E-mail

Additional Contact Information

Name Phone Ext Type

More Information

REPORT RECEIVED VIA ONLINE SUBMITTAL FORM:

MAXIMO#- 5884958 PRIV LAT CLEAN OUT PLUGGED. SEWAGE OVERFLOW ON PRIV PROP. NO SPU ASSETS AFFECTED. SEWAGE CONTAINED TO PRIVATE STRUCTURES ON PROPERTY

PRIV APARTMENT BLDG CLEAN OUT- MULTI UNIT COMPLEX. BLDG PROPERTY MNGR ON SITE ADDRESSING CLEAN UP AND REPAIR.

ONLINE SUBMITTAL FORM AVAILABLE AT:

X:\NWRO ERTS\ERTS Incident Additional Info\2015\658143

Entry Person SACAYANAN, TAMARA

Entry Date 7/14/2015

Questions?

The temperature- conductivity data logger study design:

sanitary sewage has higher conductivity and temperature than ambient stream flow in the Pacific Northwest;

if sewage enters the surface waters, temperature and conductivity will increase;

automated monitoring of temperature and conductivity at a one minute interval, 24 hrs/day may detect ephemeral pulses of sewage entering the surface waters;

deployment of multiple dataloggers allows for comparison of short stream reaches (re-deployment within suspect can further reduce the suspect bacteria source search area)

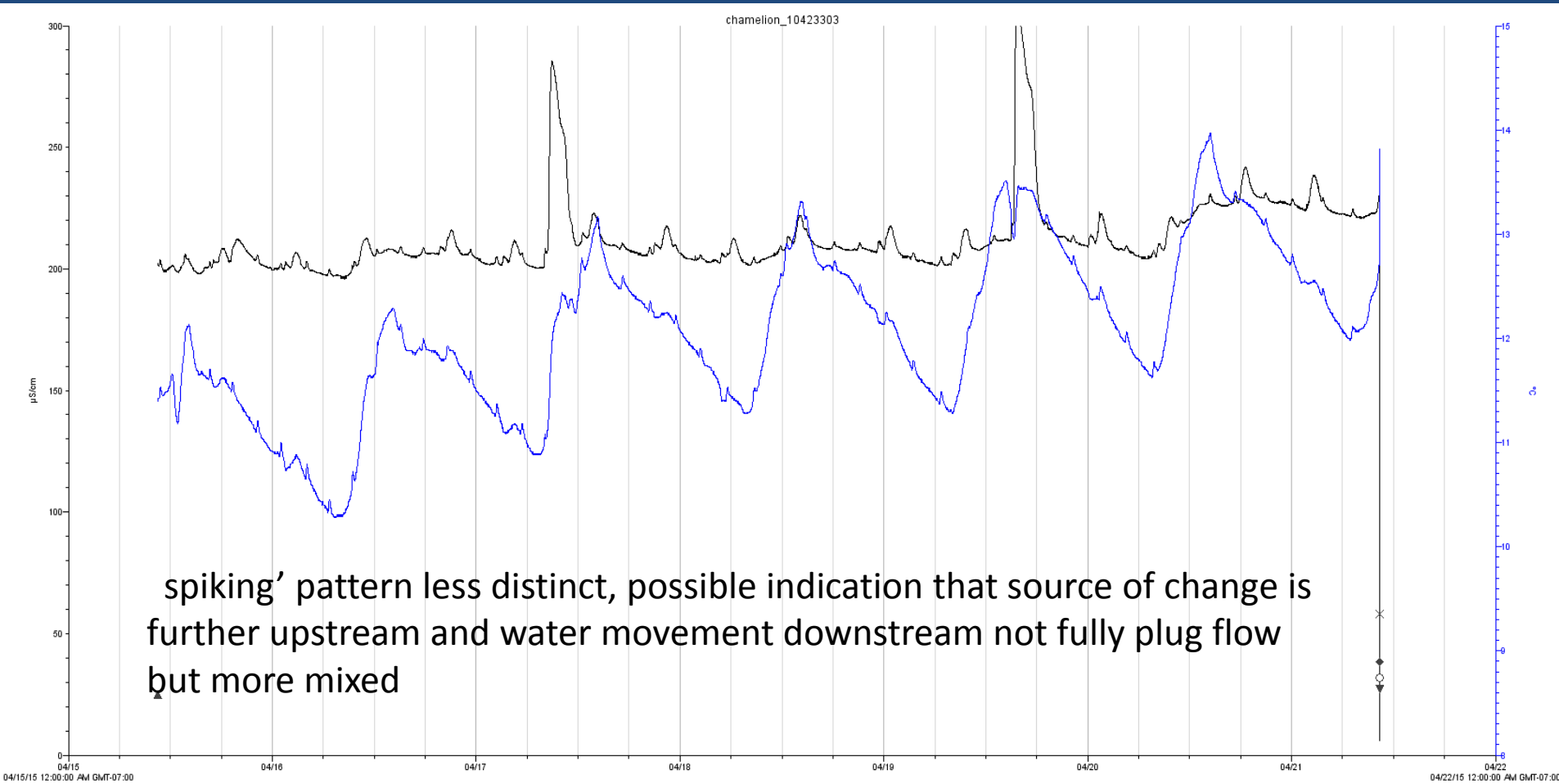
using temperature and conductivity instead of direct monitoring of bacteria to track sewage inputs:

- avoids the potential confounding bacteria sources of RV dumping and homeless encampments

- more frequent, more immediate and less expensive than direct bacteria monitoring

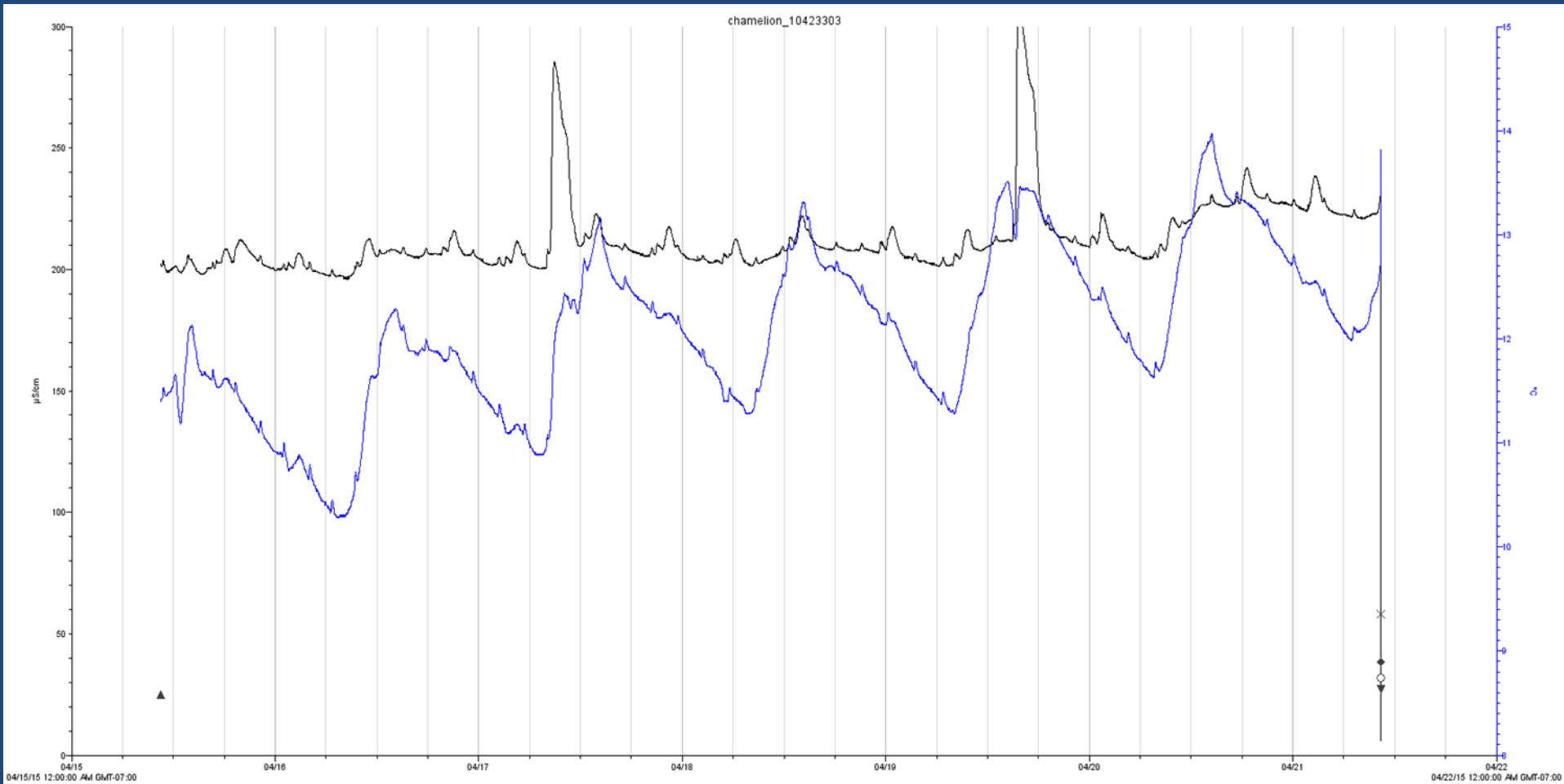
if temperature or conductivity anomalies are detected, automated composite sampling for bacteria (***E.coli*** and ***Bacteroides***) will be used to determine if the changes in temperature and conductivity are a result of sewage entering the stream segment.

Chameleon below NE 137th St



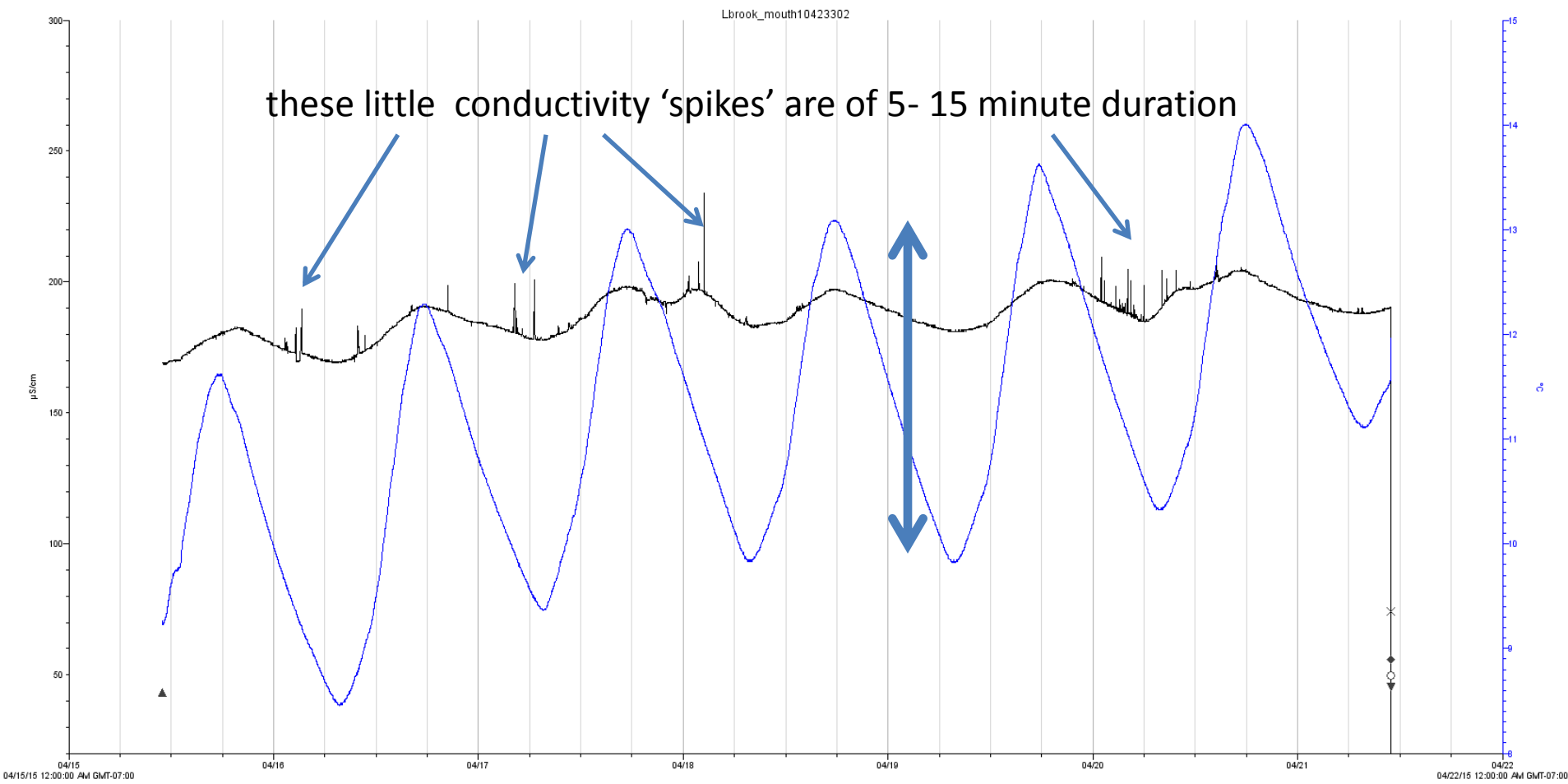
The 24 hour bacteria sampling was conducted at this location.

further downstream than optimal, but a secure location for the equipment



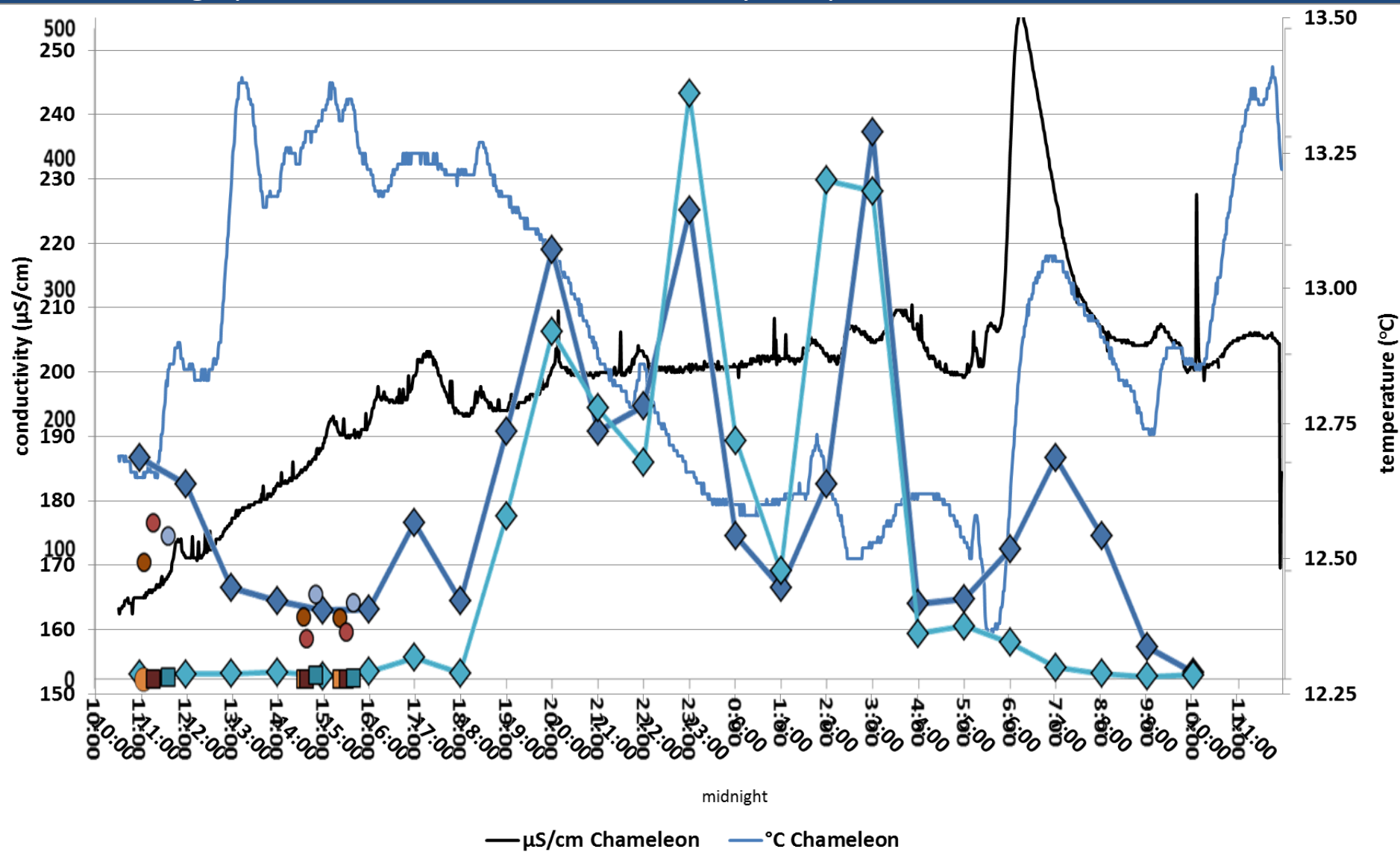
Lake City Pond –NE 125th St and 35th Ave NE

Mouth of Littlebrook Creek 36th Ave NE



much larger daily swing in temperature in this fully exposed section of Littlebrook Creek

matching up 1 minute interval data with hourly composite data



While it is difficult to have a fully 1:1 match up between the data from the temperature – conductivity loggers and the ISCO composite bacteria data, this technique appears to be a viable inexpensive technique for identifying suspect stream segments in smaller streams