Techniques for Successful Storm-Water Monitoring in a Mining Influenced Watershed

Presented by
Tom McComb, PG

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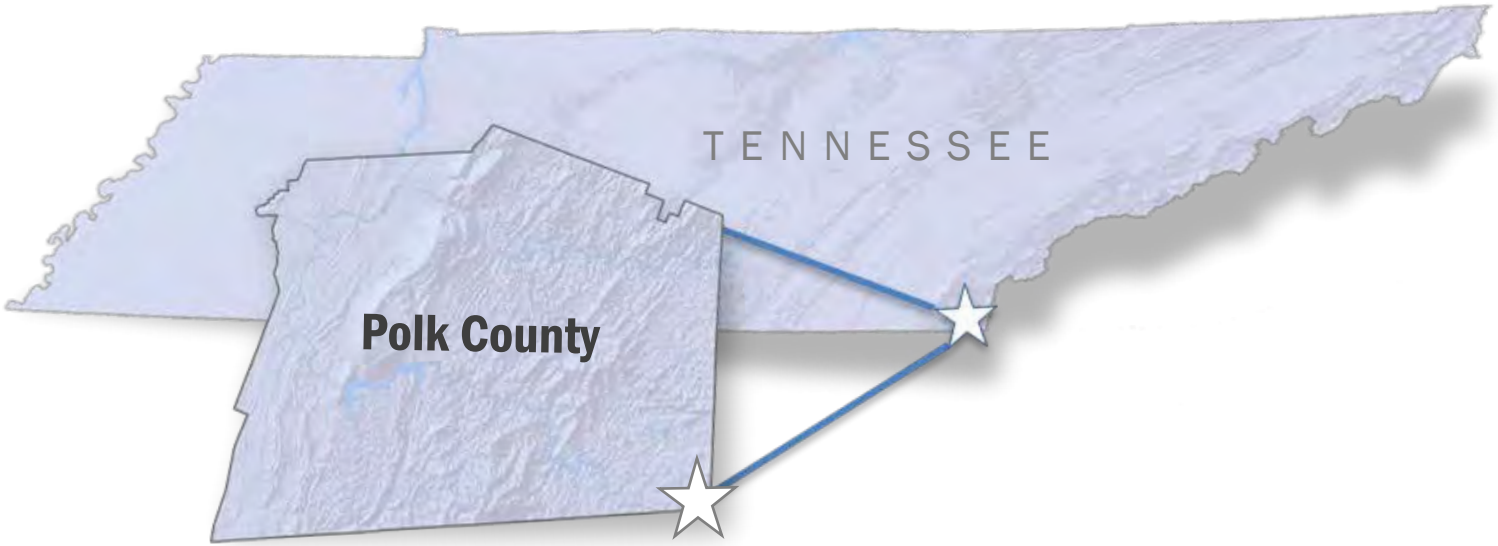
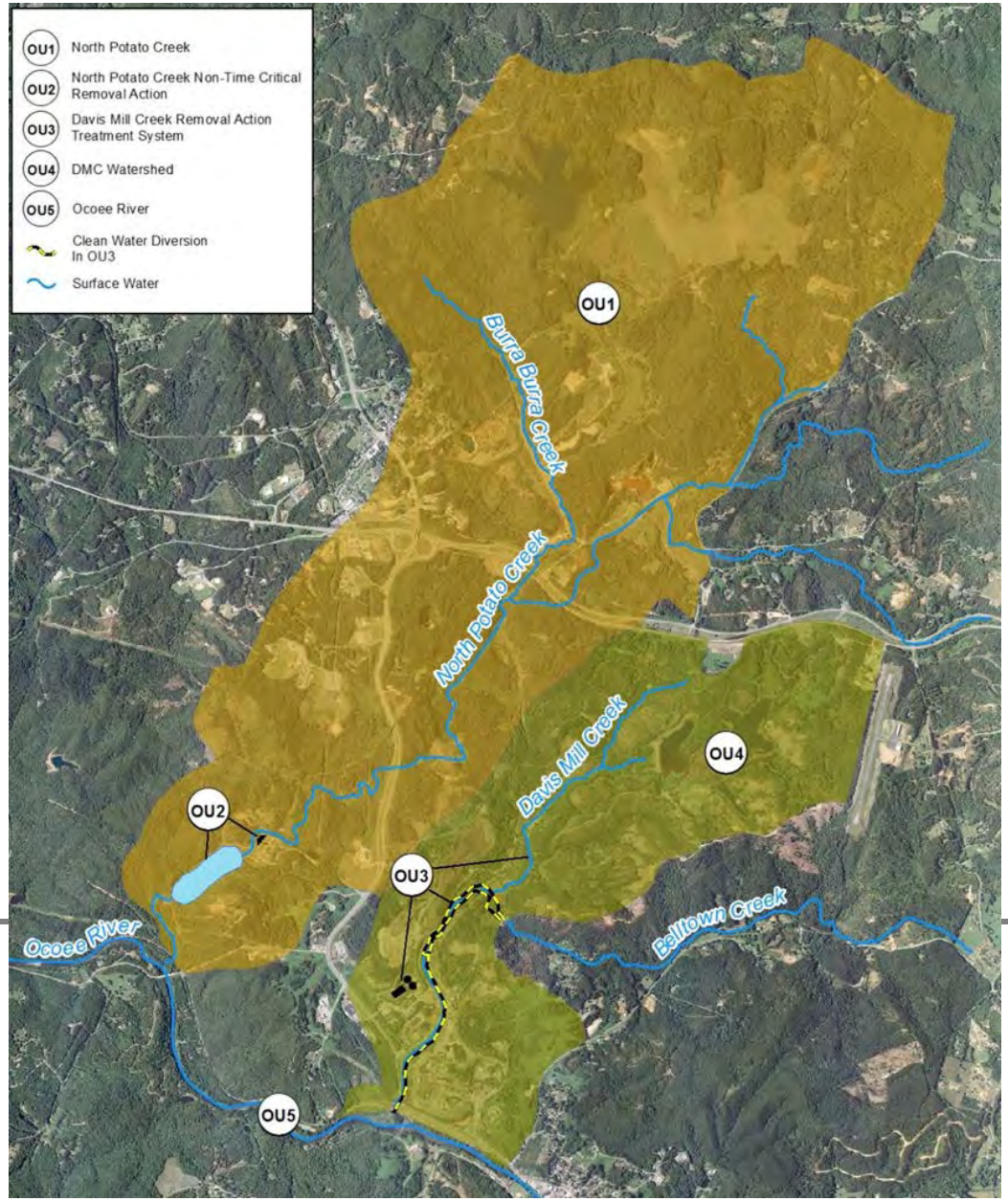
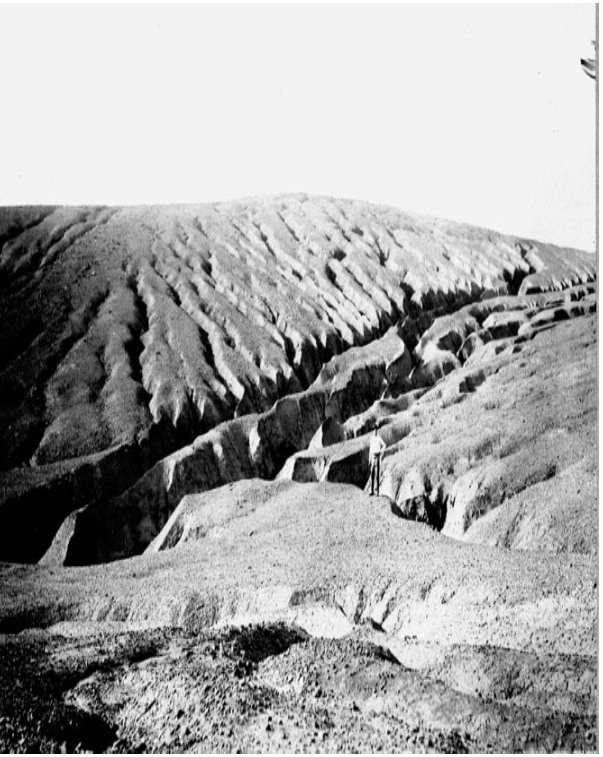
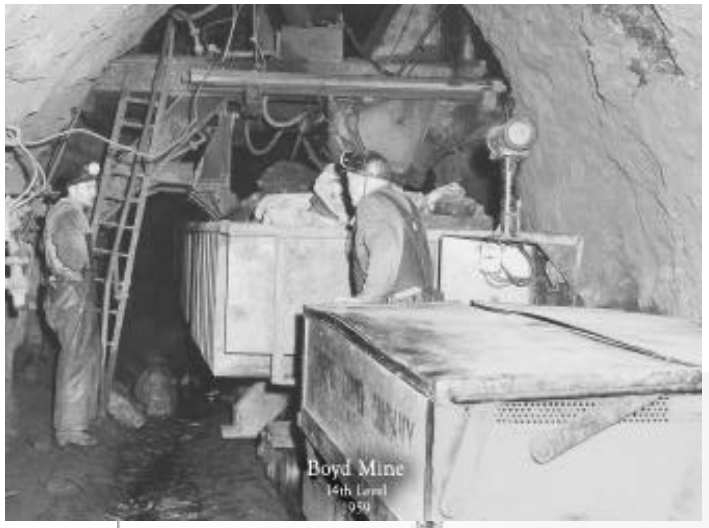


background


OU1 North Potato Creek
OU2 North Potato Creek Non-Time Critical Removal Action
OU3 Davis Mill Creek Removal Action Treatment System
OU4 DMC Watershed
OU5 Ocoee River
Clean Water Diversion In OU3
Surface Water
OU1
Burra Burra Creek
North Potato Creek
Davis Mill Creek
OU4
OU2
OU3
Ocoee River
Bellfown Creek
OU5




Isabella


Boyd Mine
14th Level


Burra Burra


2001


2004

1 Identification of sources of contaminants

Benefits

Identification of sources of contaminants

Identification of first flush events

Comparison of base-flow and storm-flow conditions

2 Identification of first flush events

Benefits

Identification of sources of contaminants

Identification of first flush events

Comparison of base-flow and storm-flow conditions

3 Comparison of base-flow and storm-flow conditions

Benefits

Identification of sources of contaminants

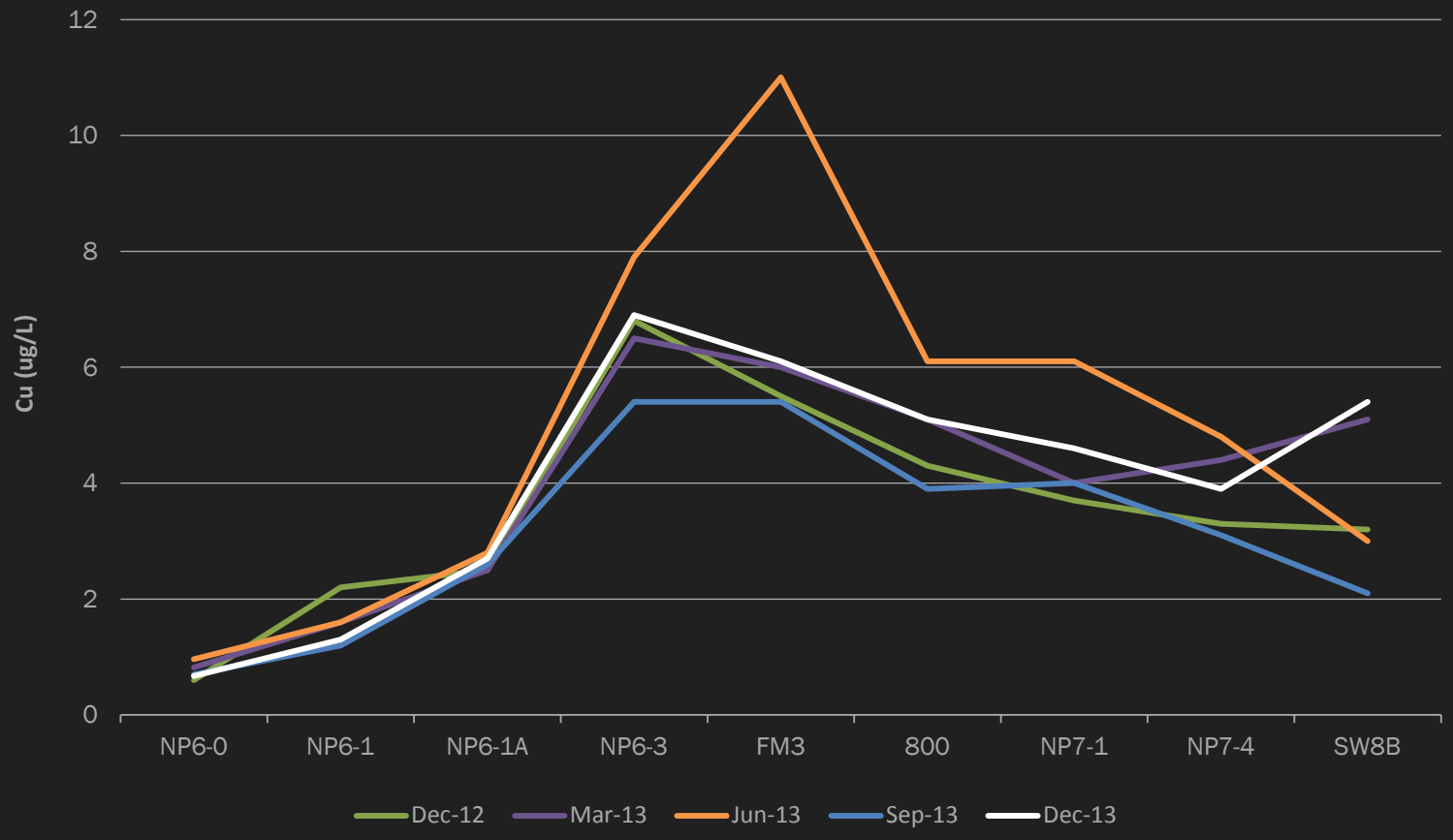
Identification of first flush events

Comparison of base-flow and storm-flow conditions

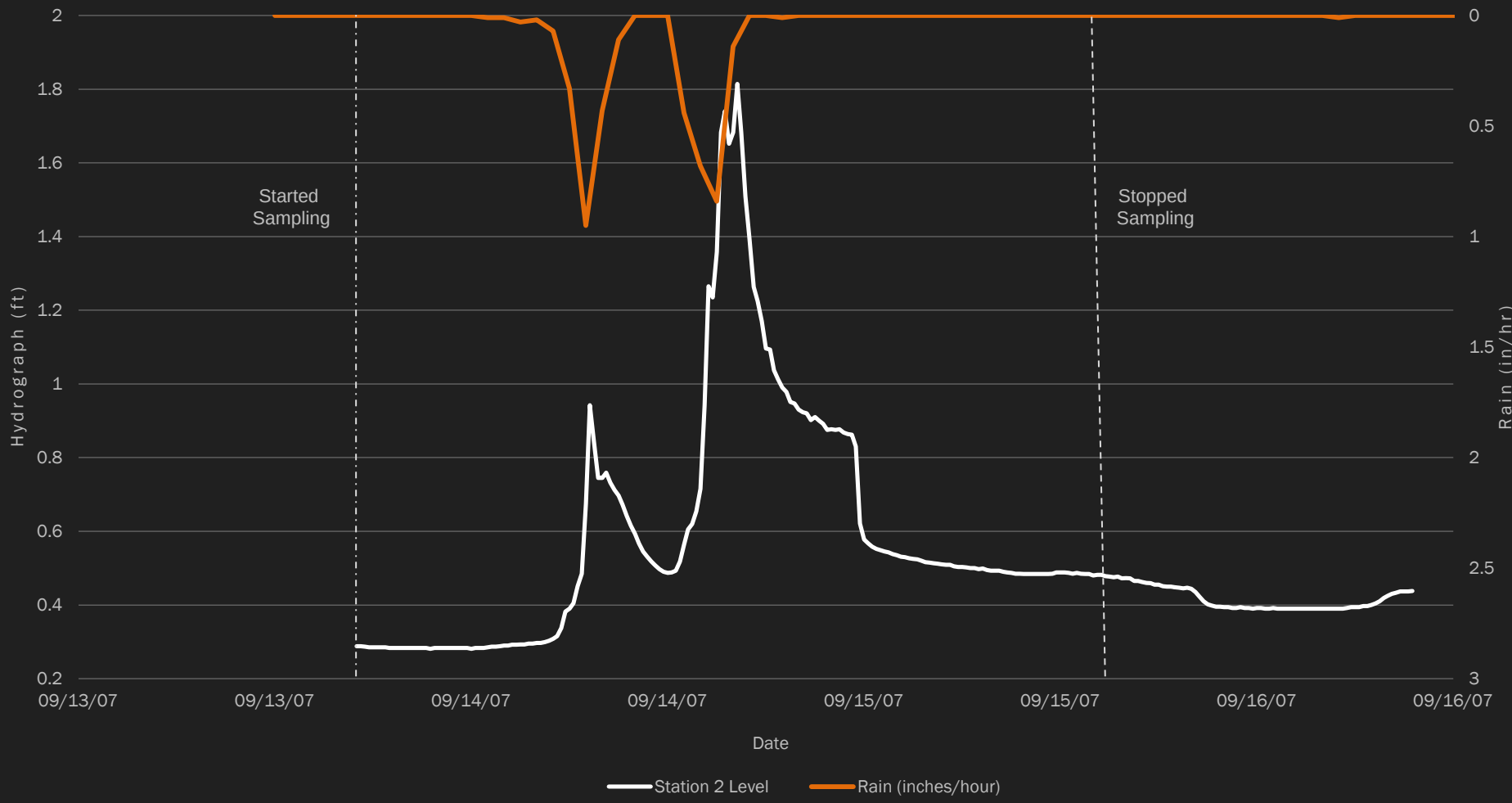
Source Identification

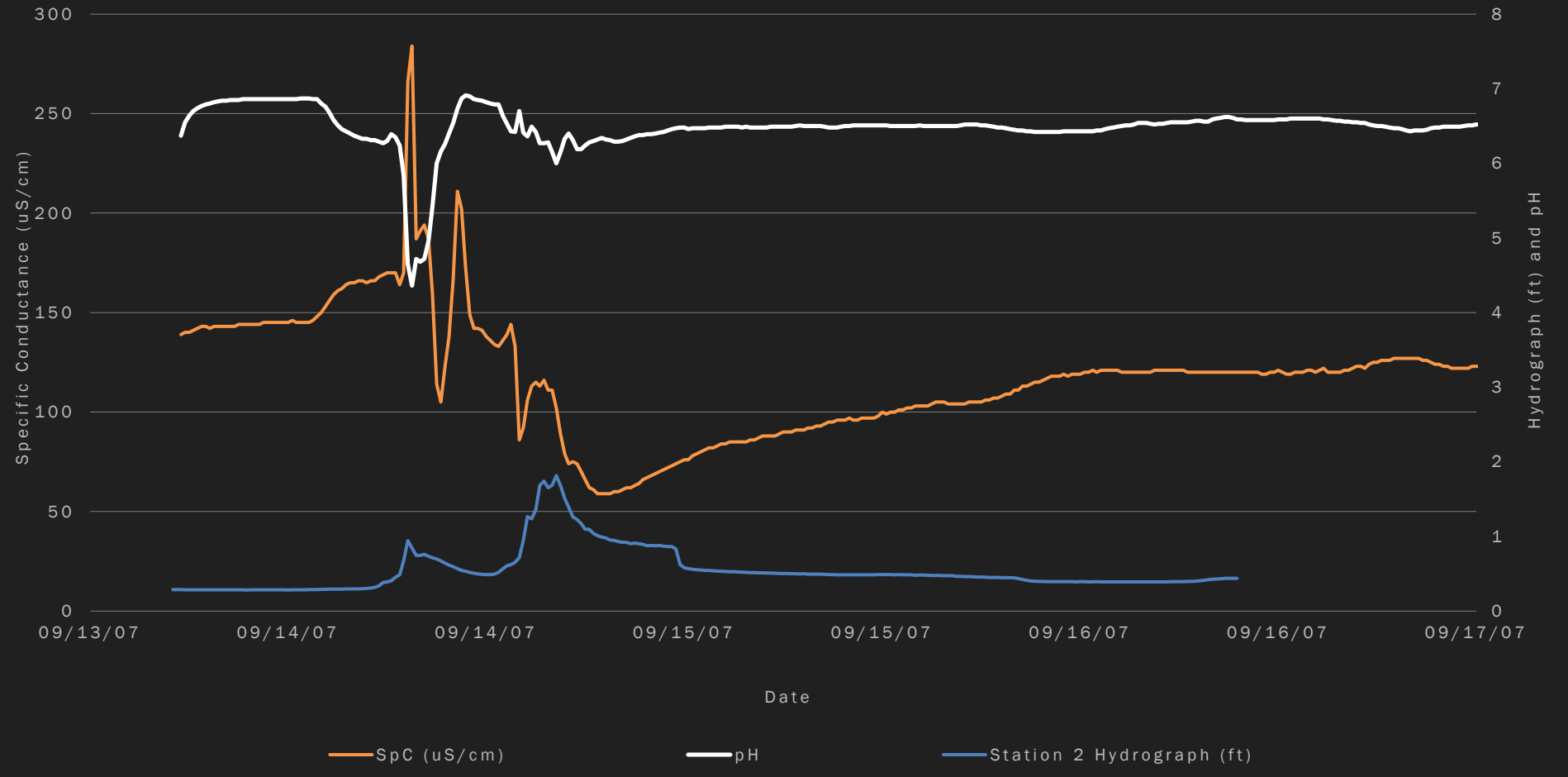
Base-Flow Dissolved Copper

December 2012 through December 2013

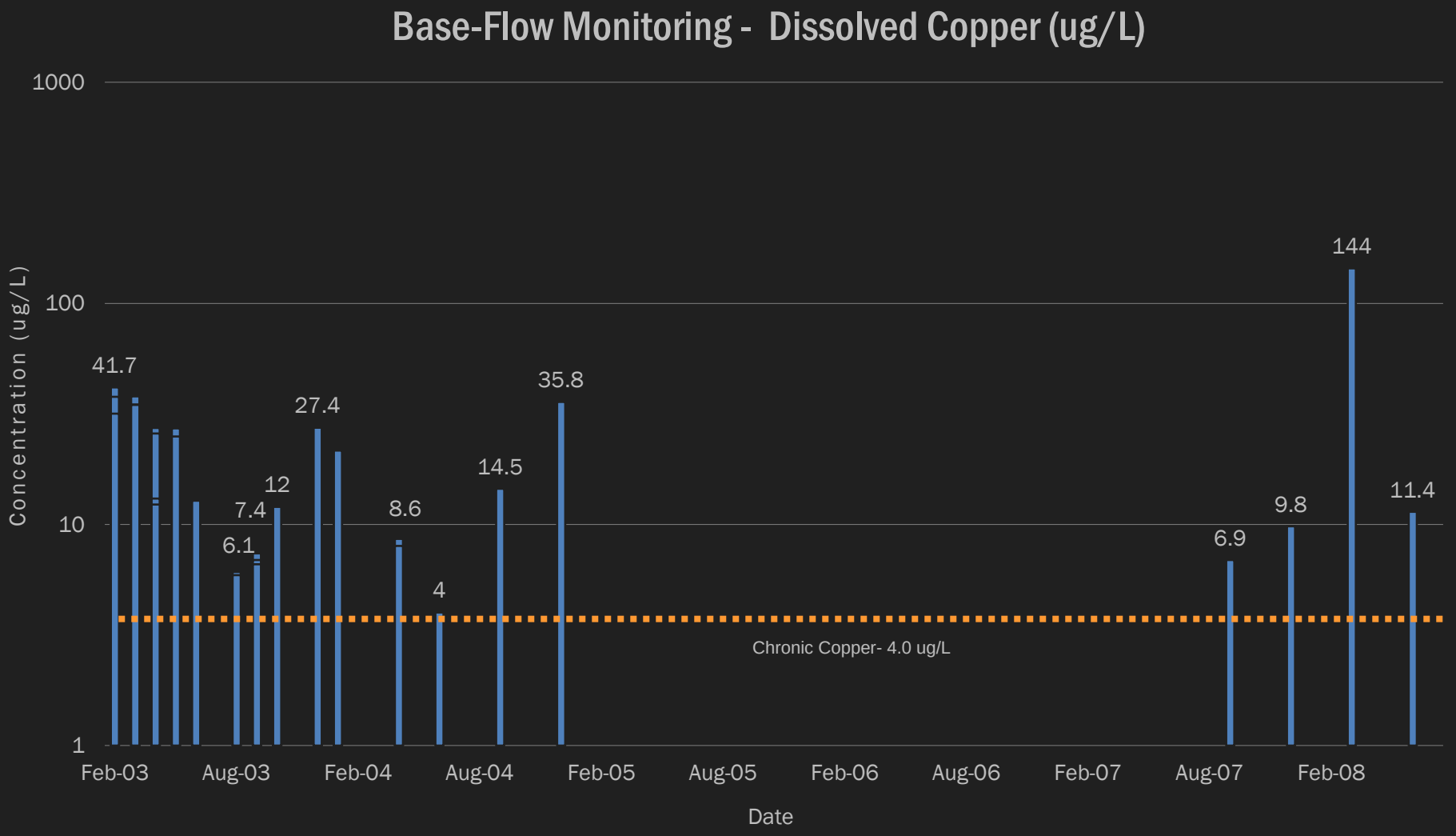


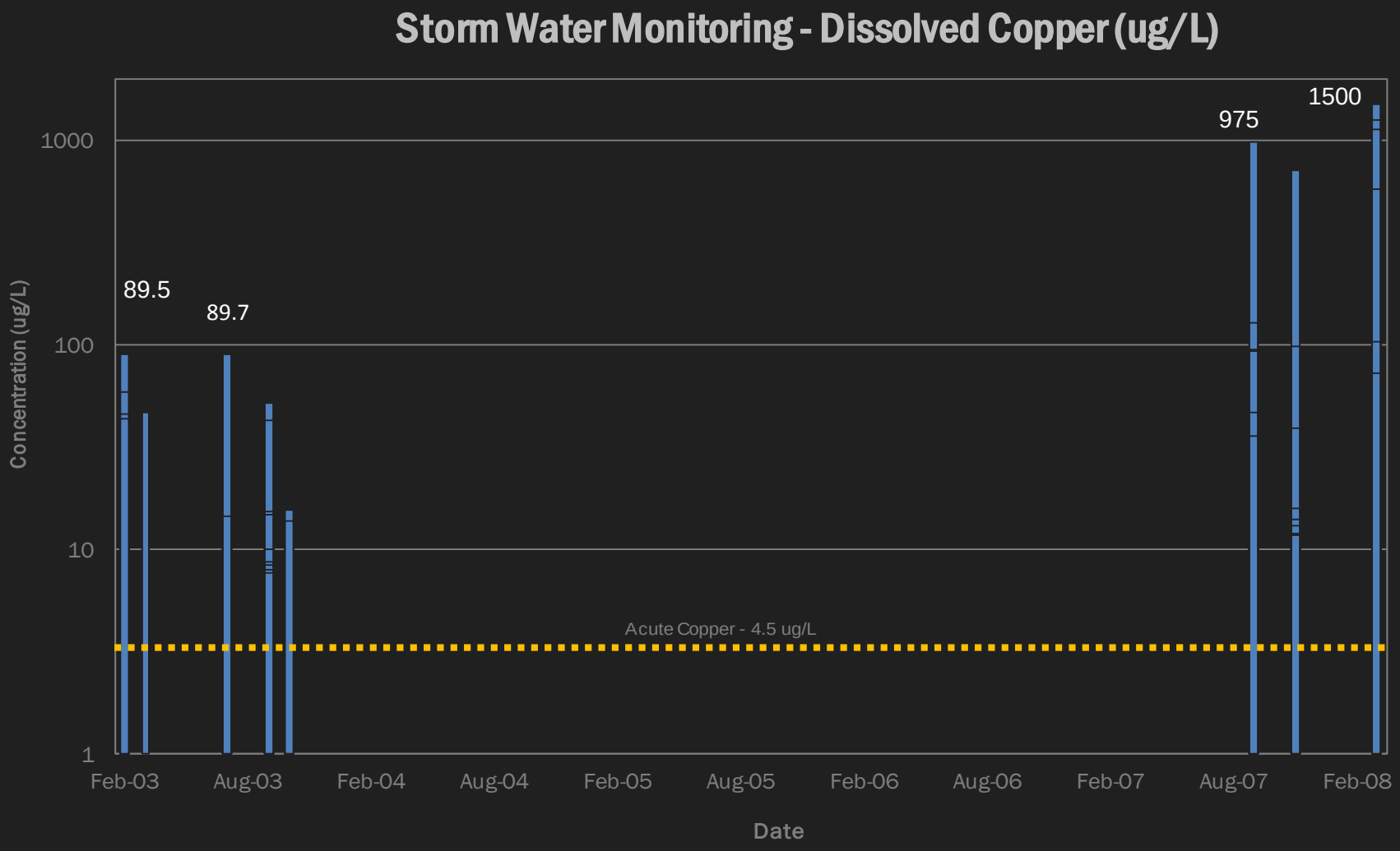
First Flush


2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
Hydrograph (ft)
0
0.5
1
1.5
2
2.5
3
Rain (in/hr)
Started Sampling
Stopped Sampling
09/13/07
09/13/07
09/14/07
09/14/07
09/15/07
09/15/07
09/16/07
09/16/07
Date
Station 2 Level
Rain (inches/hour)


300
250
200
150
100
50
0
Specific Conductance (uS/cm)
8
7
6
5
4
3
2
1
0
Hydrograph (ft) and pH
09/13/07
09/14/07
09/14/07
09/15/07
09/15/07
09/16/07
09/16/07
09/17/07
Date
SpC (uS/cm)
pH
Station 2 Hydrograph (ft)

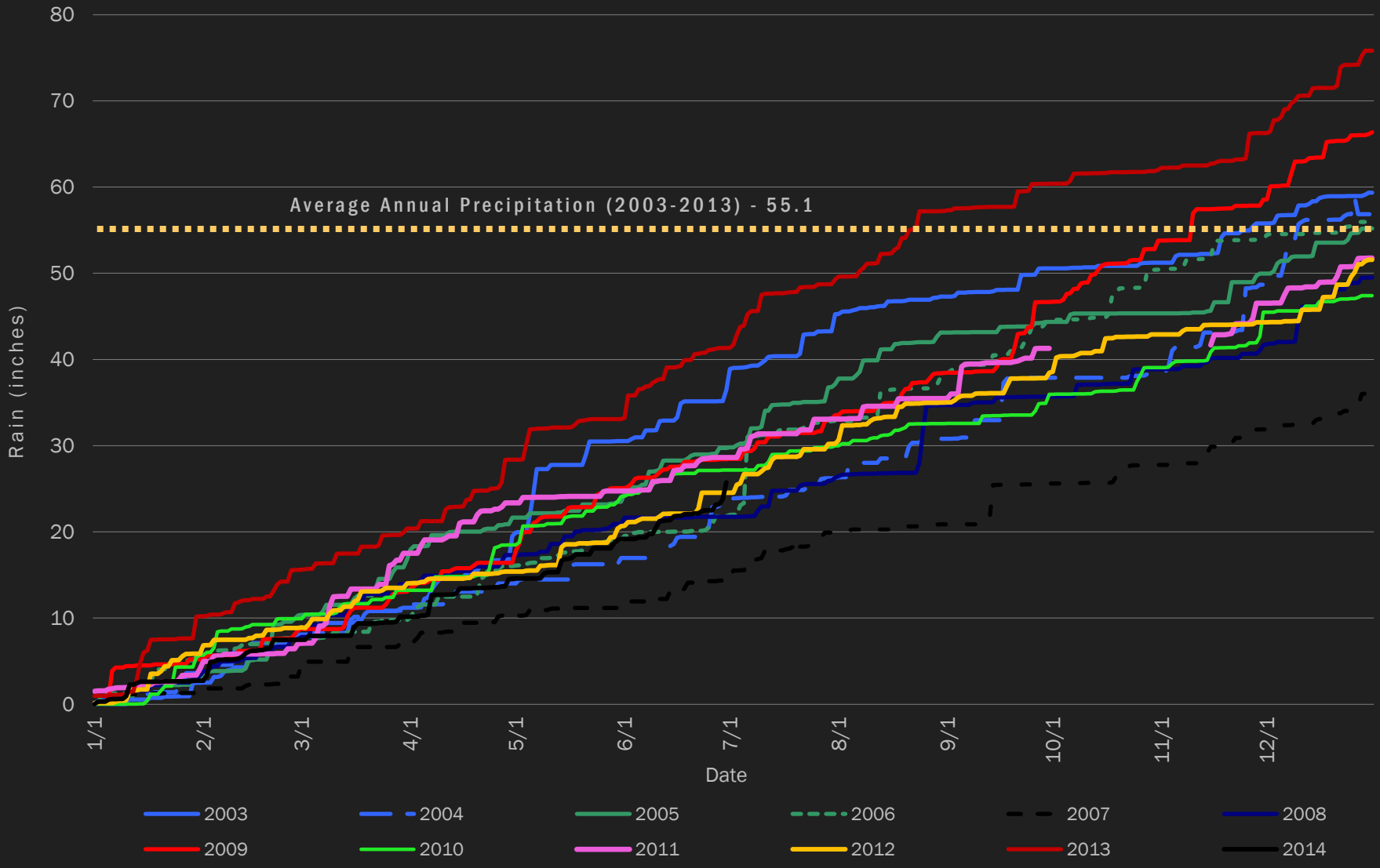
Storm Flow vs. Base Flow


Base-Flow Monitoring - Dissolved Copper (ug/L)
1000
100
10
1
Concentration (ug/L)
41.7
6.1
7.4
12
27.4
8.6
4
14.5
35.8
6.9
9.8
144
11.4
Chronic Copper- 4.0 ug/L
Feb-03
Aug-03
Feb-04
Aug-04
Feb-05
Aug-05
Feb-06
Aug-06
Feb-07
Aug-07
Feb-08
Date


Storm Water Monitoring - Dissolved Copper (ug/L)
1000
100
10
1
Concentration (ug/L)
89.5
89.7
975
1500
Acute Copper - 4.5 ug/L
Feb-03
Aug-03
Feb-04
Aug-04
Feb-05
Aug-05
Feb-06
Aug-06
Feb-07
Aug-07
Feb-08
Date

So… when does this take place?

Annual Cumulative Rain (inches)
2003 - 2014



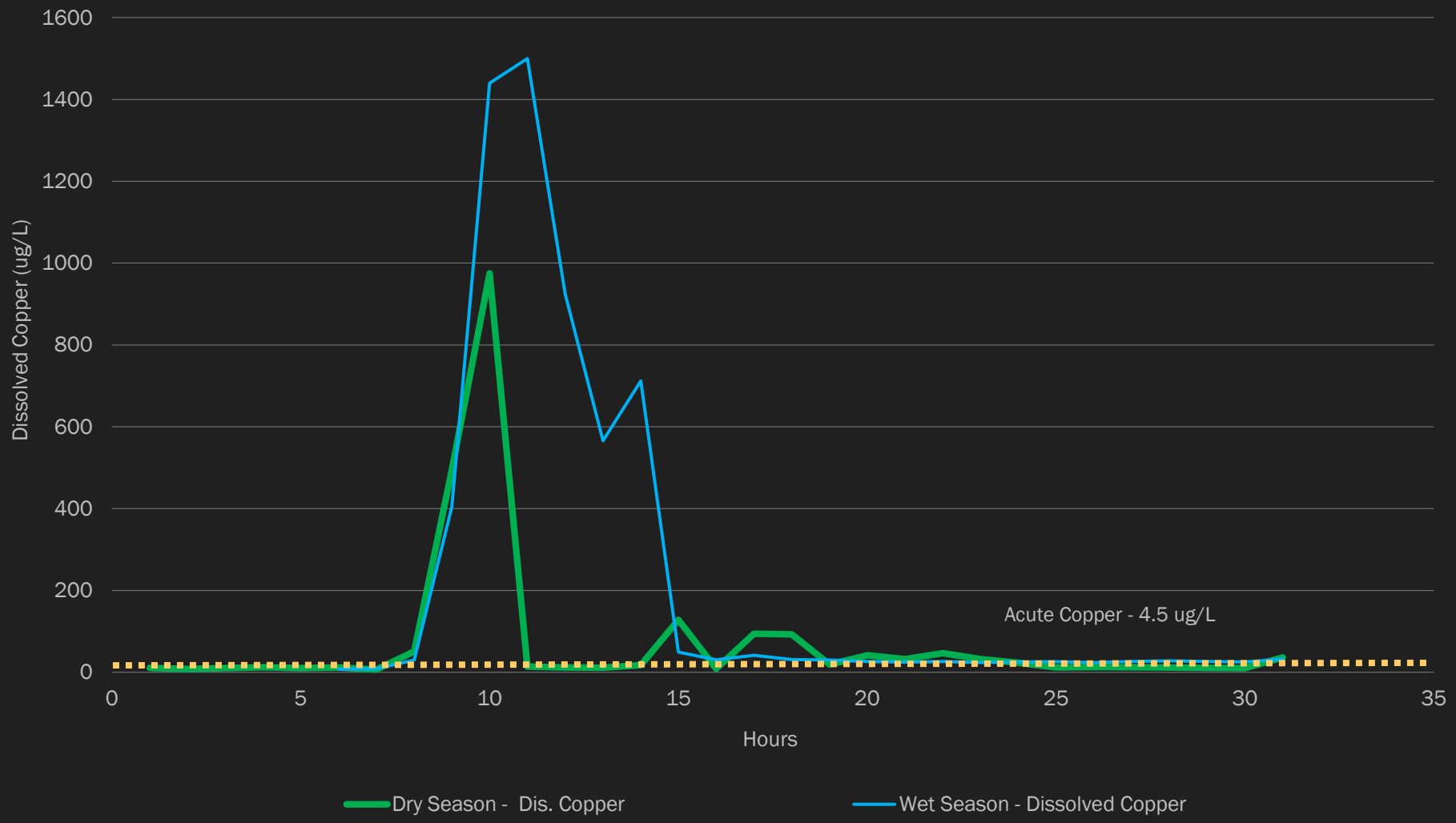
presence of metal salts

When : **dry** season

Interstitial water flow

When : **wet** season

Dry Season vs. Wet Season



Setup

Analytical Suites vs Available Sample Volumes

- Area/Velocity Meter
- Autosampler
- Hydrolab
- Rain gauge/weather station
- Field computer and printer

!

Setup : Equipment

Set up equipment <u>two weeks prior</u> to anticipated sampling event

Source areas

Stream Channel

Hydraulics

Security

Safety

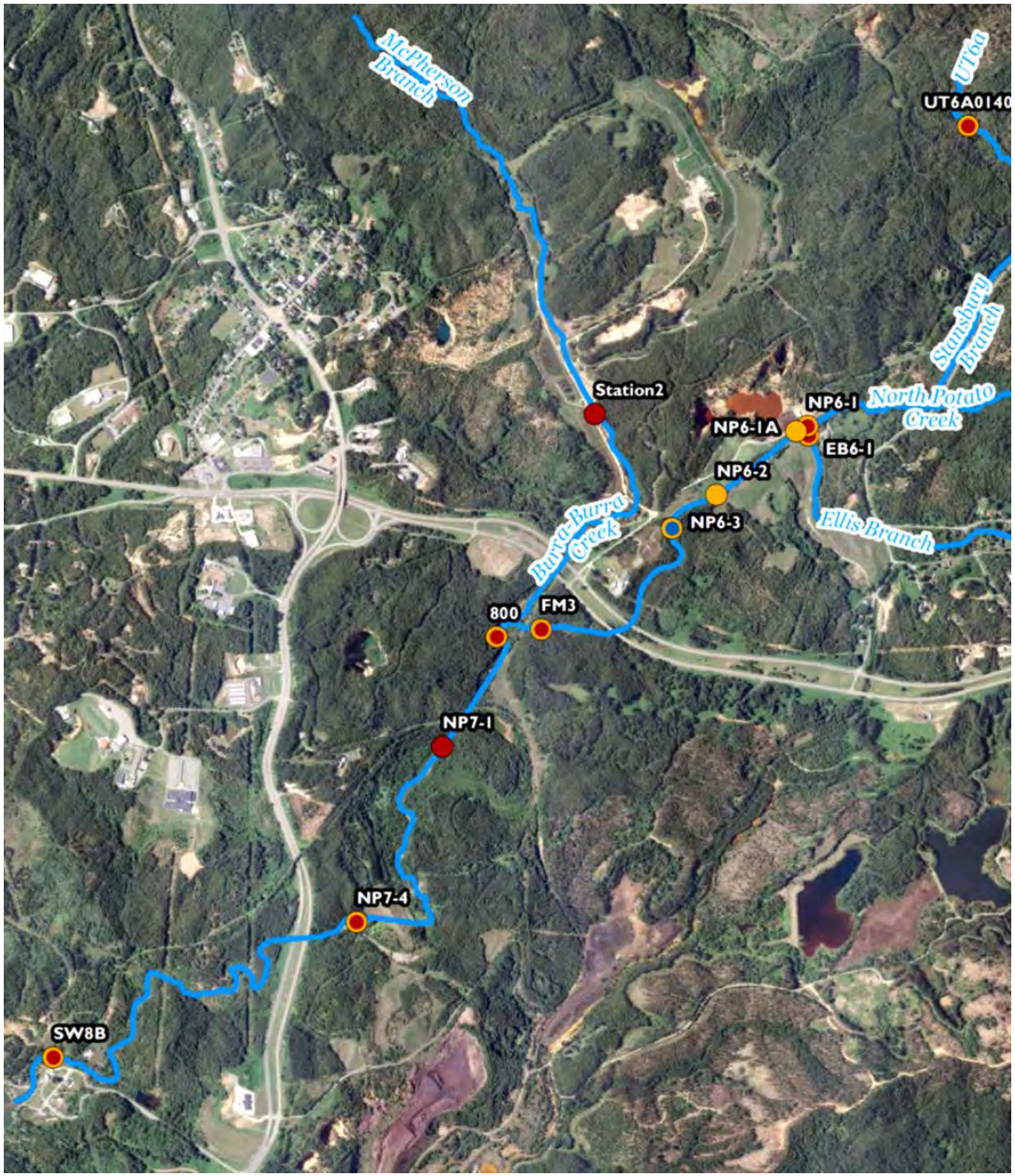
Location Considerations

Source areas

Stream Channel Hydraulics

Security

Safety


McPherson Branch
UT6A
UT6A0140
Stansbury Branch
North Potato Creek
Station2
NP6-1
NP6-1A
EB6-1
NP6-2
NP6-3
Burro-Burro Creek
Ellis Branch
800
FM3
NP7-1
NP7-4
SW8B

Setup

1. Building/improving trails to the selected sample locations
2. Securing the area velocity probe onto the stream bed
3. Surveying the stream cross section
4. Installing the area velocity meter and autosampler above flood levels

...

Setup

5. Securing autosampler's suction line from the creek to the sampler

6. Installing flow-through pipes for the Hydrolabs

7. Calibrating the meters and samplers

- Sample bottles
- Silicon tubing
- Filters
- Liquinox
- Shipping forms
- Calibration fluids
- Coolers
- Tape and tape guns
- Sampling forms
- Flashlights
- Vehicles
- Zip-lock bags
- Trash bags
- Di-water
- Batteries
- Trail markers
- Paper towels
- Water proof pens
- Computer
- Printer
- Printer ink
- Computer label paper
- Chocolate
- Snacks

Setup : Supplies

Safety

Safety : Use experienced field crew

- *use the buddy system*
- *cell phones + contact info*
- *reflective vests*
- *avoid flood waters*
- *daily safety meetings*

Safety : Establish meeting points

Safety : Alert client, site workers, and security of schedule

Startup

Check weather forecasts!

Rain events typically start on weekends and national holidays

Startup : Auto Samplers

- install charged batteries
- install ice
- set the clock
- program start time
- confirm sample tubing is clear and in the water

Startup : Area/Velocity Meter

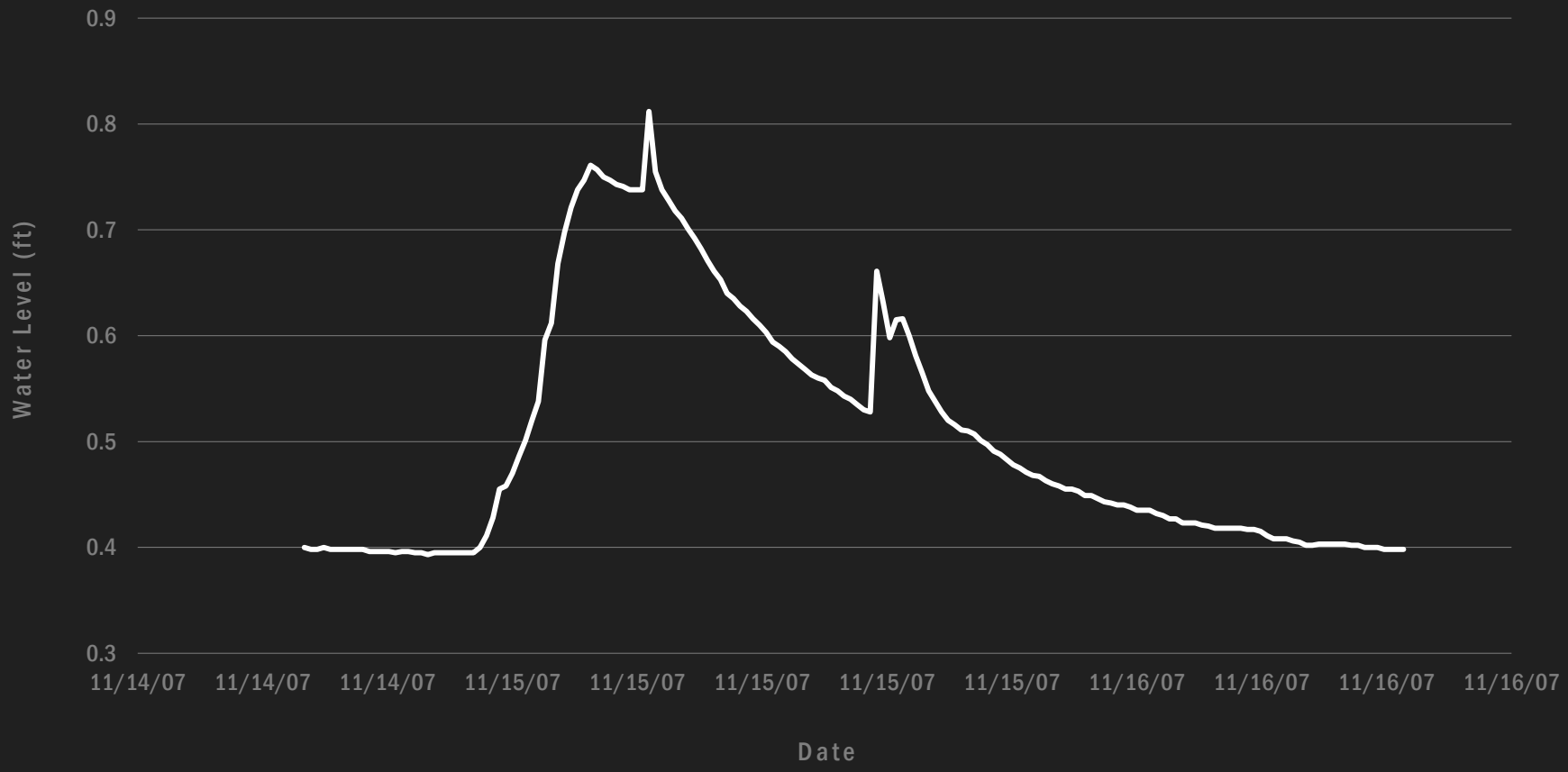
- Install new batteries
- Confirm instrument is recording depth and velocity

Startup : Hydrolabs

- Install batteries
- Check calibration
- Check installation

Make field-crew assignments

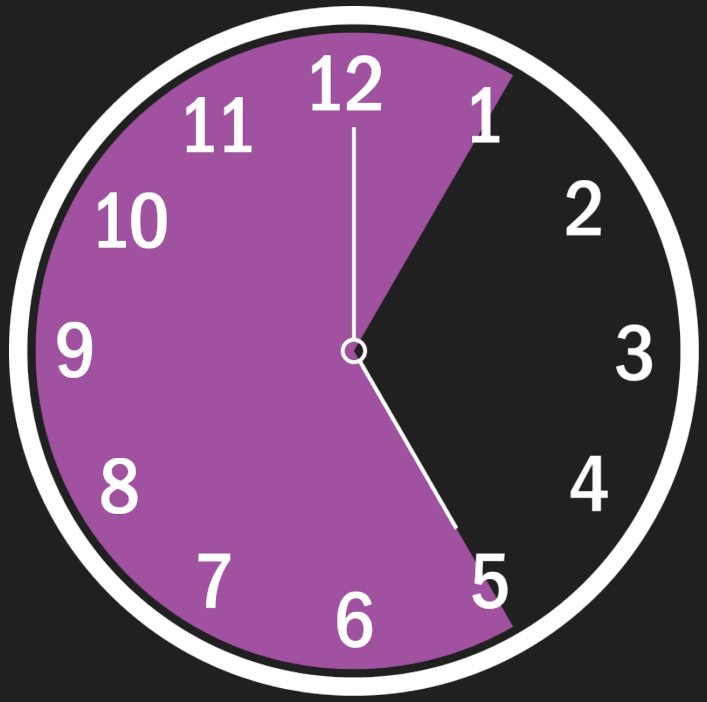
Duration


0.9
0.8
0.7
0.6
0.5
0.4
0.3
Water Level (ft)
11/14/07
11/14/07
11/14/07
11/15/07
11/15/07
11/15/07
11/15/07
11/15/07
11/16/07
11/16/07
11/16/07
11/16/07
Date

Autosampler Typical Runtime

12 hour intervals

A.M. Schedule



P.M. Schedule

Recommendations

- Sample labelling
- Sample filtering
- Bottle setup
- Shipping
- Decontamination
- Supplies of expendable materials

Lessons Learned

- **Keep it simple**
- **Keep the sample intervals the same** at all locations
- **Notify the lab** once the storm-water sampling event has started

...

Lessons Learned

- **Have a set process**
  (removing bottles from autosamplers, labelling, and filling out COC forms)
- **Look out for other activities within watershed**
  (treatment plant discharges, construction activities, beaver dam breaks)

Typical problems

- Inaccurate weather forecasts
- Dead batteries
- Hydrolabs washed up on bank or surfing
- Autosampler Problems
  - Incomplete restart
  - Accidental shut off
  - Ice jam on rotator arm
  - Sample bottles floating in carrousel
  - Suction line out of water/frozen
  - Error in water detection unit

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