Lower Yahara River Elevation Study
September – November 2009

Friends of Lake Kegonsa Society (FOLKS)
Mike Amstadt (Vice president –Lake Affairs)
June 23, 2011

Study objective

- “Determine if there are one or more natural or manmade features in the Yahara River’s path that are seriously restricting the flow of water from Lake Waubesa into Lake Kegonsa”

Purpose of the Study

- “Gather additional data to help determine whether there is any benefit from lowering Lake Kegonsa to increase the head between Lake Waubesa and Lake Kegonsa”

Study funding

- The FOLKS Board authorized an expenditure of $2,900 for equipment rentals, supplies, and professional surveyor services
- LLS members volunteered their time and equipment to conduct the study

Presentation outline

1. 13 day transducer study
2. Follow-up GPS study
3. Next steps

13 Day Transducer Study

September 13-25, 2009

Initial plan

- Install multiple recording transducers at sites along the Lower Yahara River
- Collect data for a two week period (Budget limitations)

Equipment

- The transducer used to collect data was a Micro-Diver datalogger
- The Micro-Diver is capable of collecting 48,000 pressure measurements
  - Dimensions: 18 mm x 88 mm
  - Accuracy ± 1.0cmH_2O
  - Resolution ± .2cmH_2O

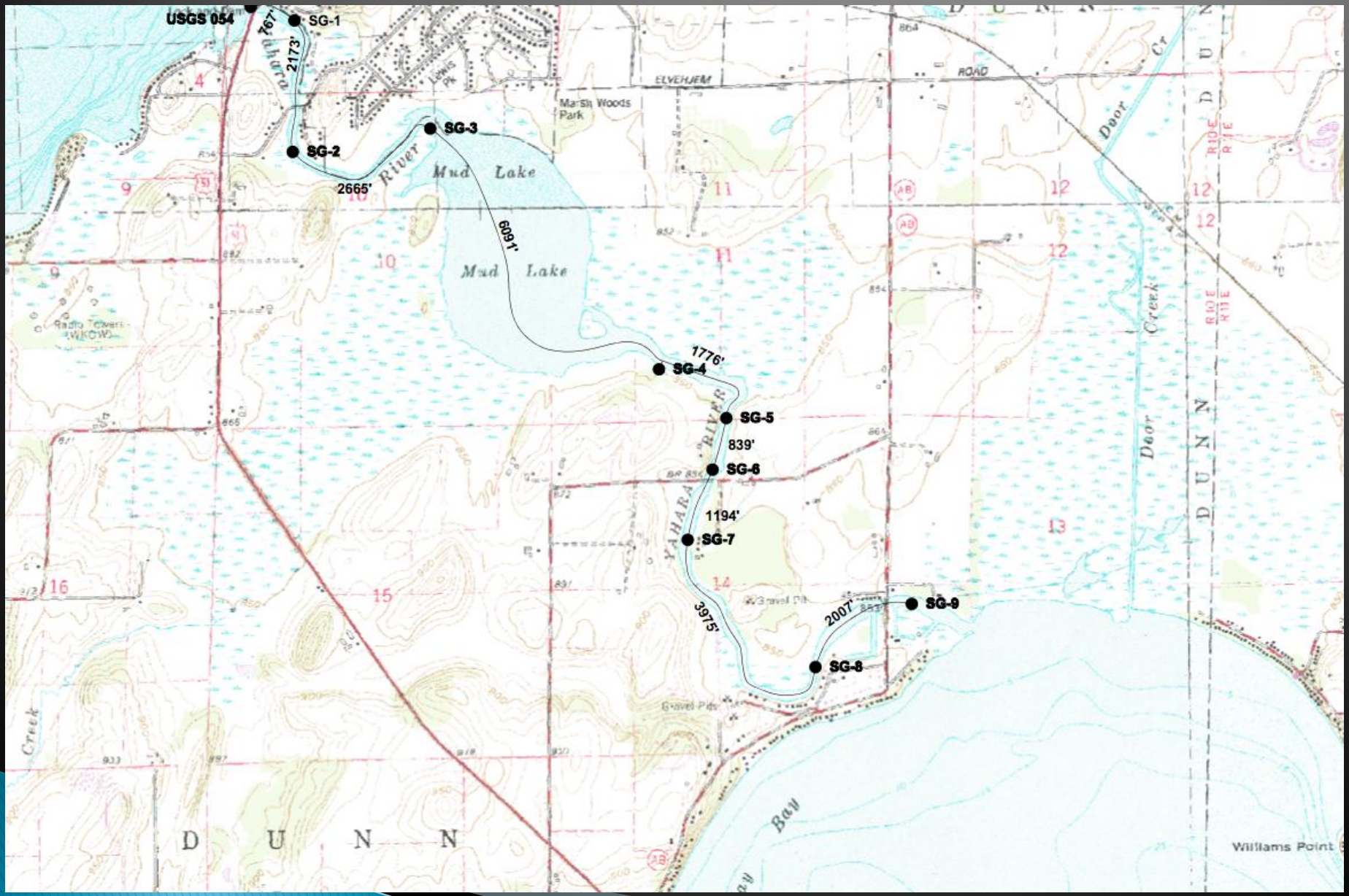
Equipment

- The transducer was suspended inside a 24” PVC tube
- The tube had holes drilled in it to allow water to freely enter it

Site selection criteria

- Dane County/DNR suggested sites
- Potential points of interest such as bridges or other obstructions
- Available locations to install the device

Final site selection



Final site selection

Installation of the transducer

- The transducer was activated
- The PVC tube was securely attached to a post or pier with clamps so the transducer was entirely under water
- GPS survey equipment was used to determine the elevation and location of the transducer

The Data

- Each transducer was set to collect and store the pressure reading every 30 minutes
- Each transducer collected approximately 570 pieces of data (September 13 – 25)

Transducer Data Adjustments

- Distance from top of pipe to the transducer
- Transducer calibration
- Barometric pressure & altitude

River Elevation Calculation

Elevation = GPS reading for top of tube
– distance from top to transducer
+ transducer pressure reading ftH_2O
– barometric pressure [a]
+ transducer calibration factor [b]

[a] Weather Underground barometric pressure at Fitchburg converted to ft H_2O

[b] calibration factor adjusts barometric pressure reading for elevation and compensates for differences between transducers

River Elevation Calculation

Example

Elevation = *844.93* (GPS reading)

– *1.71* (distance to transducer)

+ *34.34* (transducer pressure reading)

– *33.93* (barometric pressure)

+ *.87* (transducer calibration factor)

Elevation = *844.50*

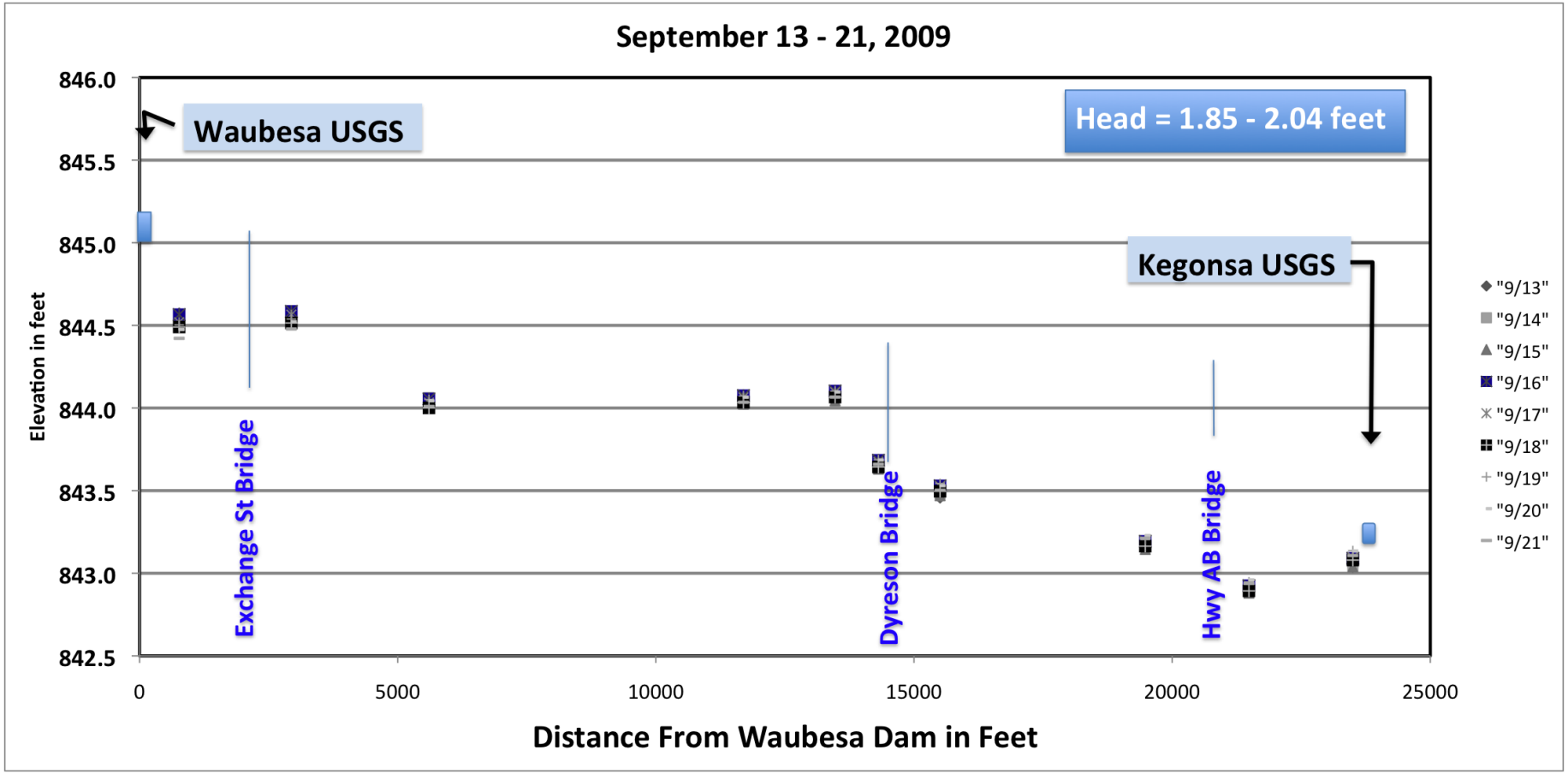
13 Day Transducer Study

Results

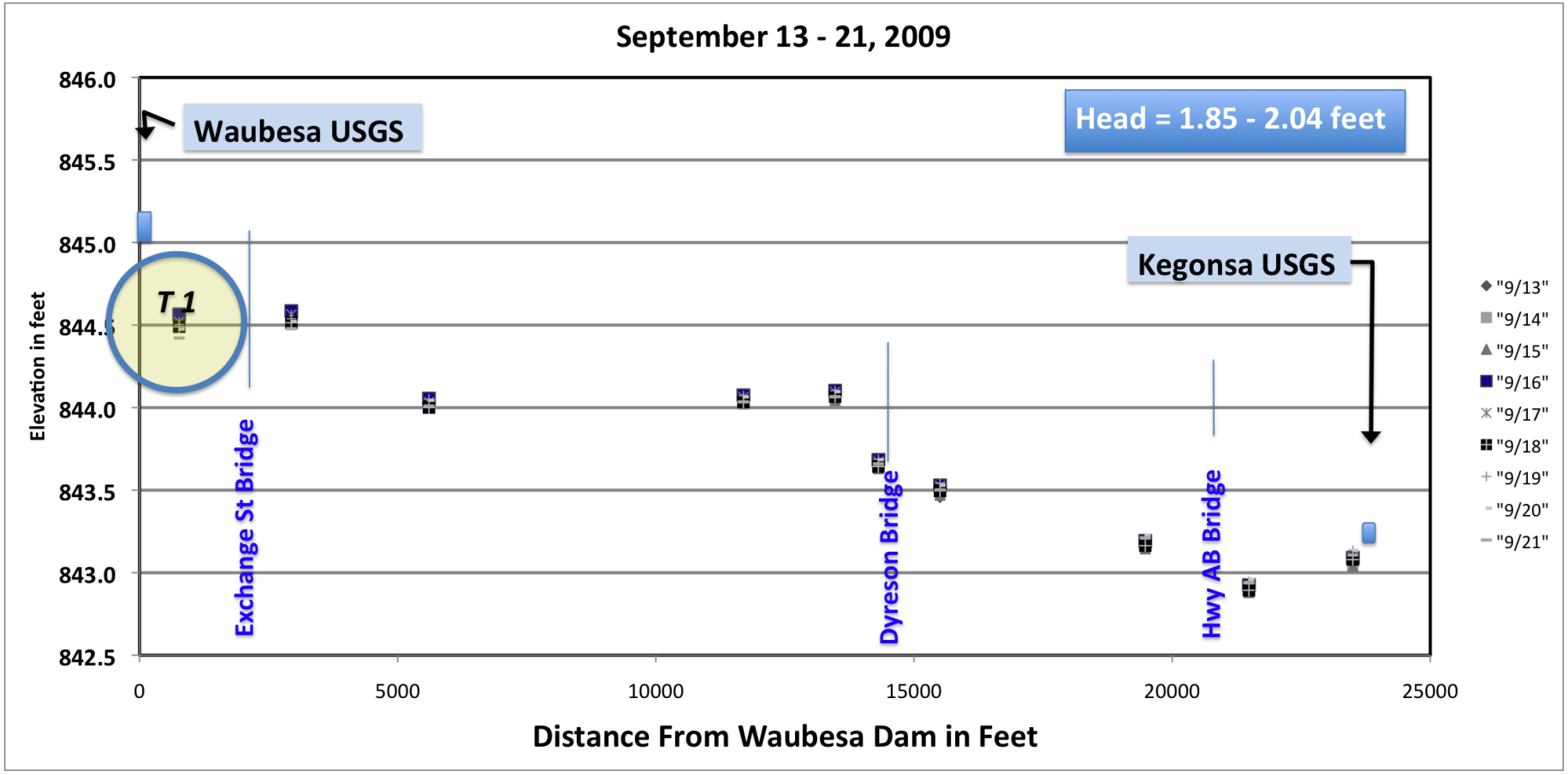
Daily Mean Values

- First nine days (Sept 13 – Sept 21)

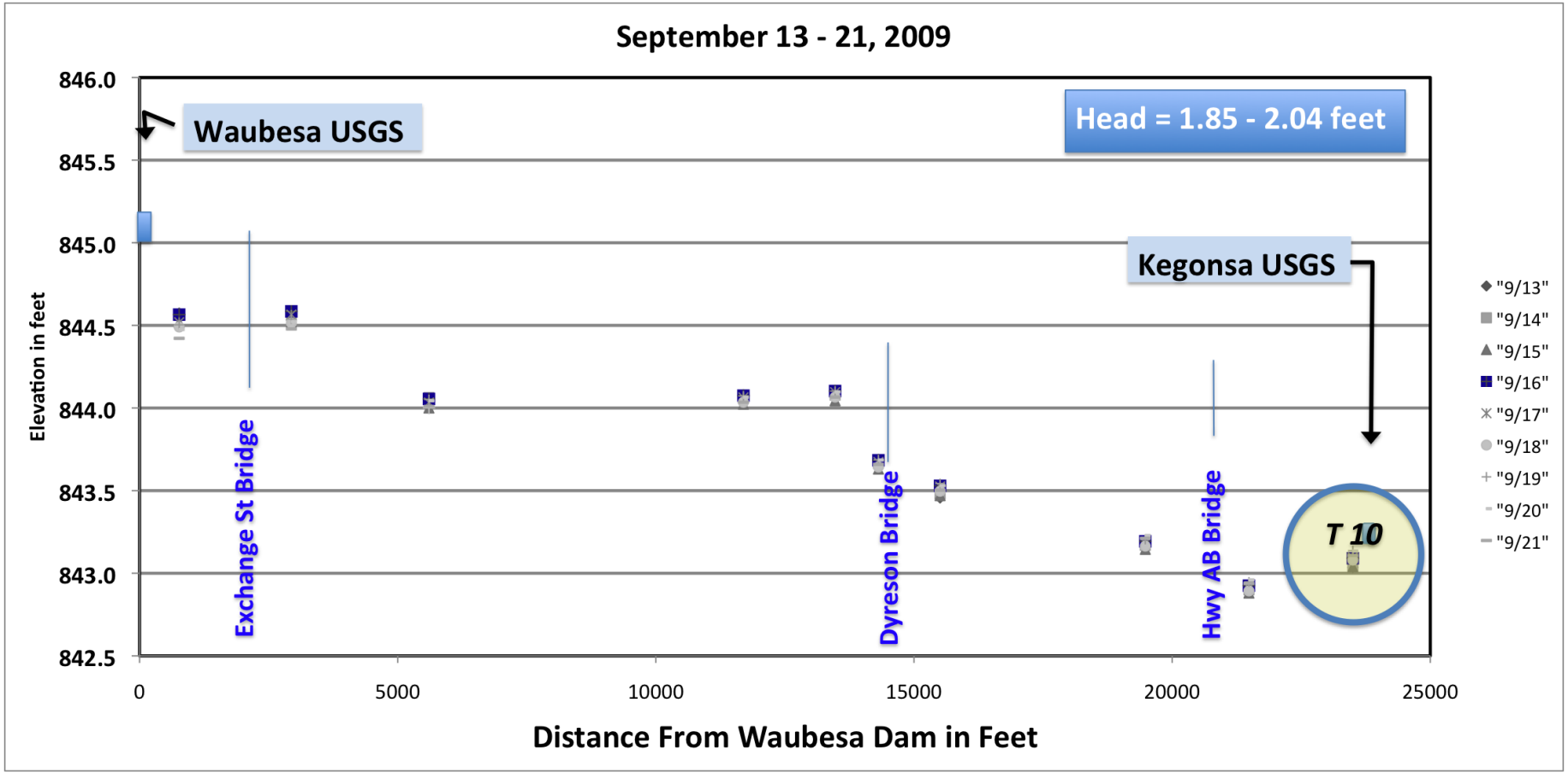
Daily Means for First 9 Days



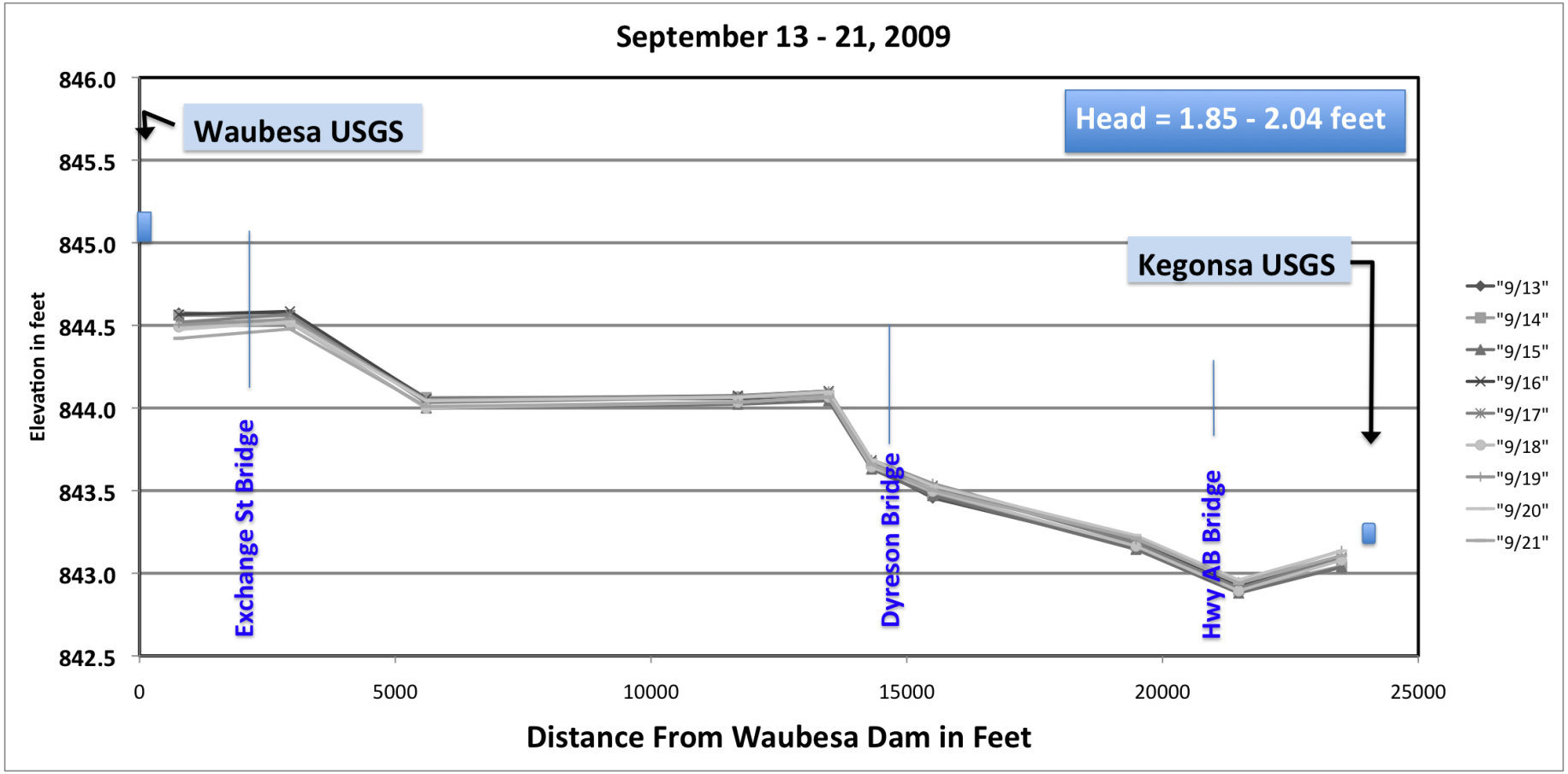
Transducer 1 Problems



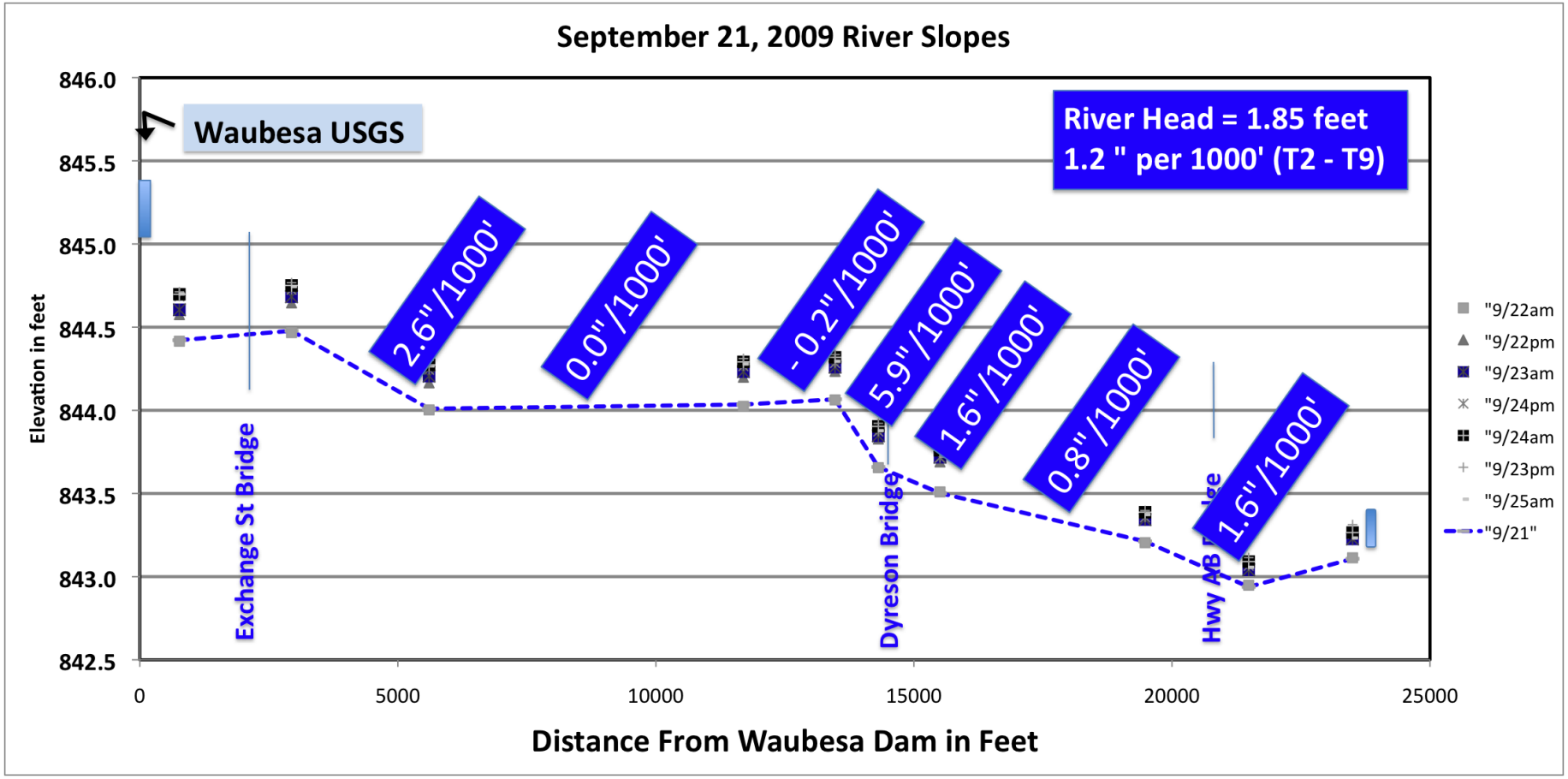
Scale Across Lake Kegonsa



Apparent River Profile



Varying Slopes



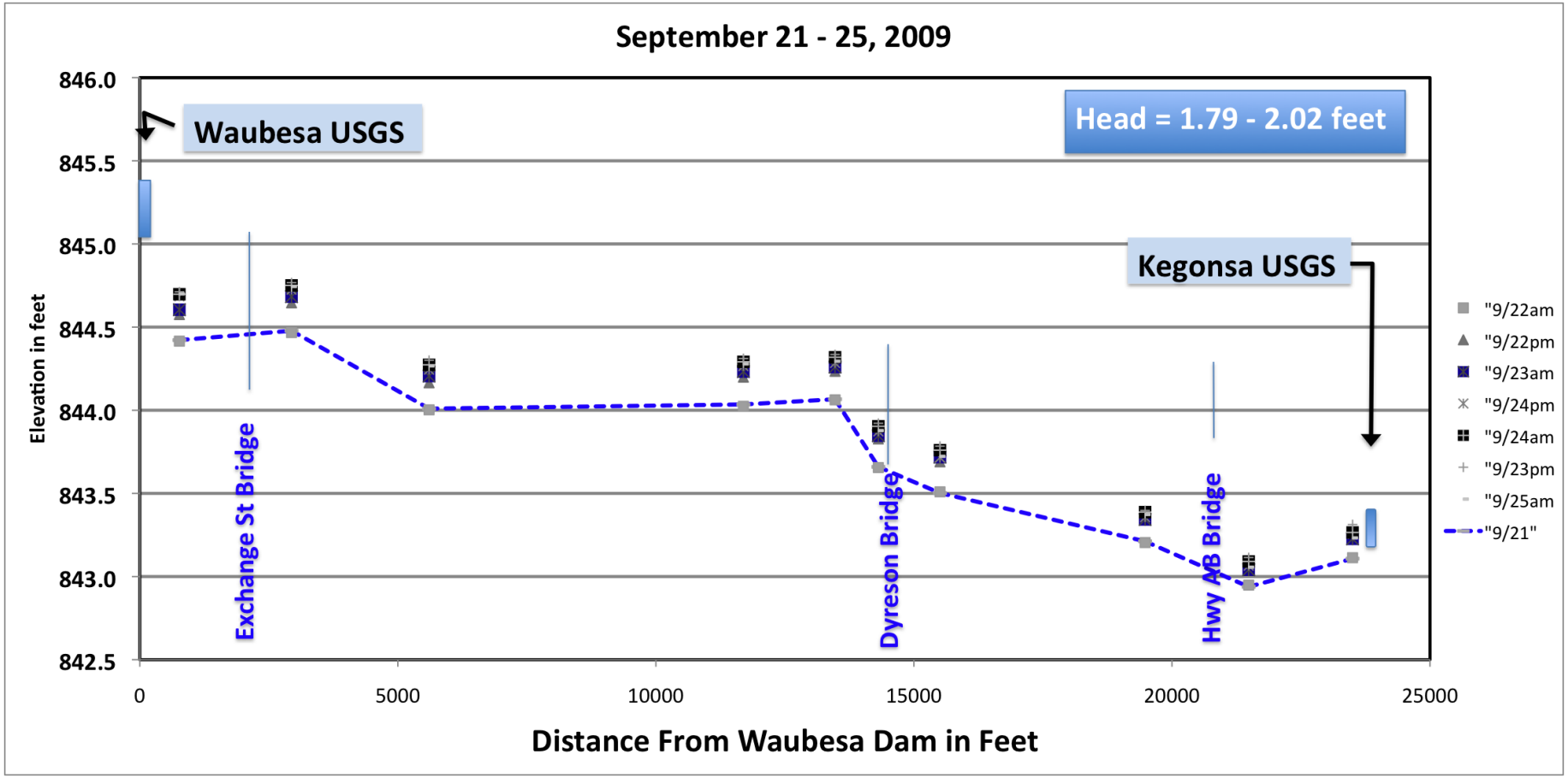
Half-Day Mean Values

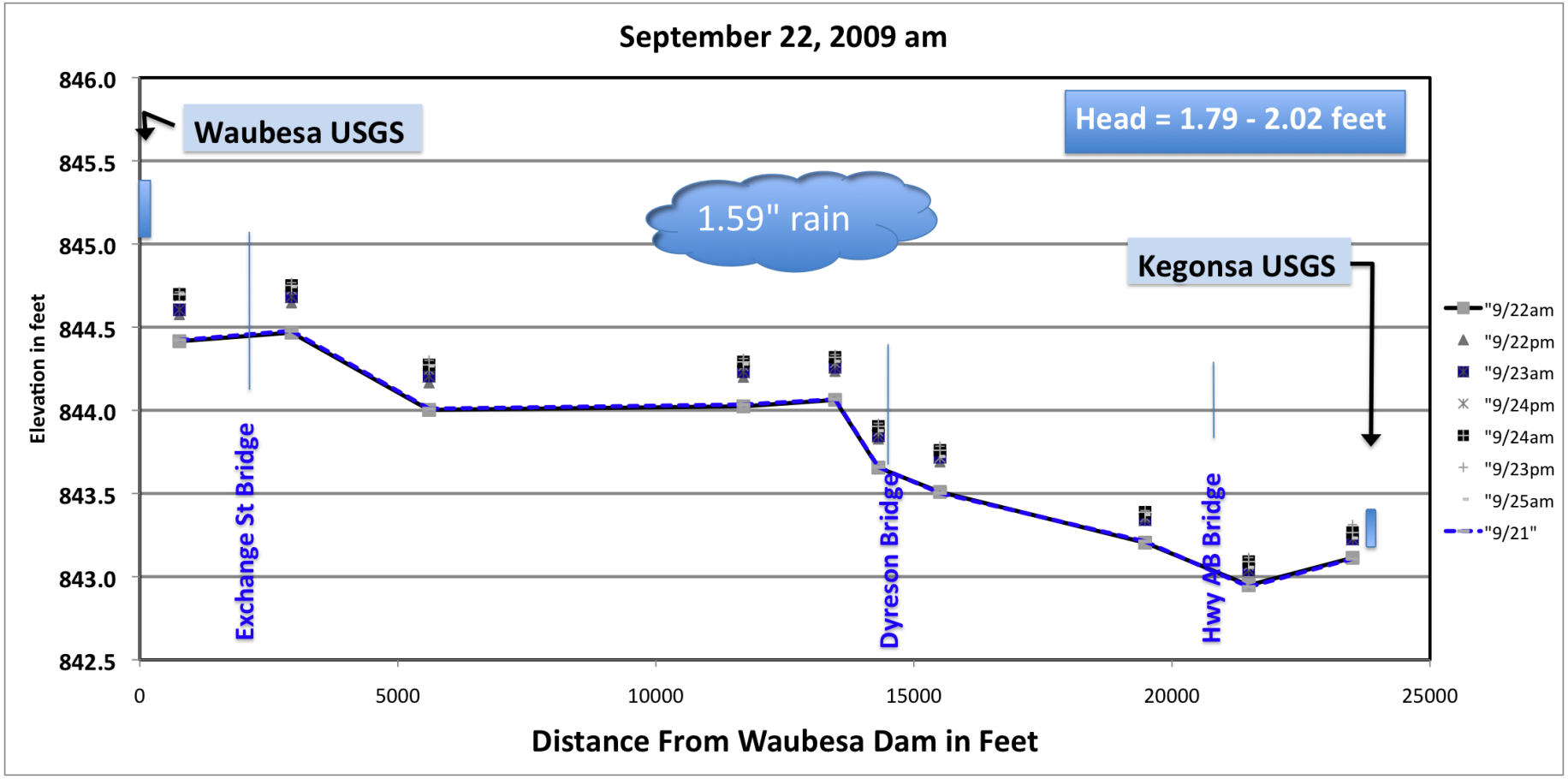
Last four days (Sept 22 – 25)

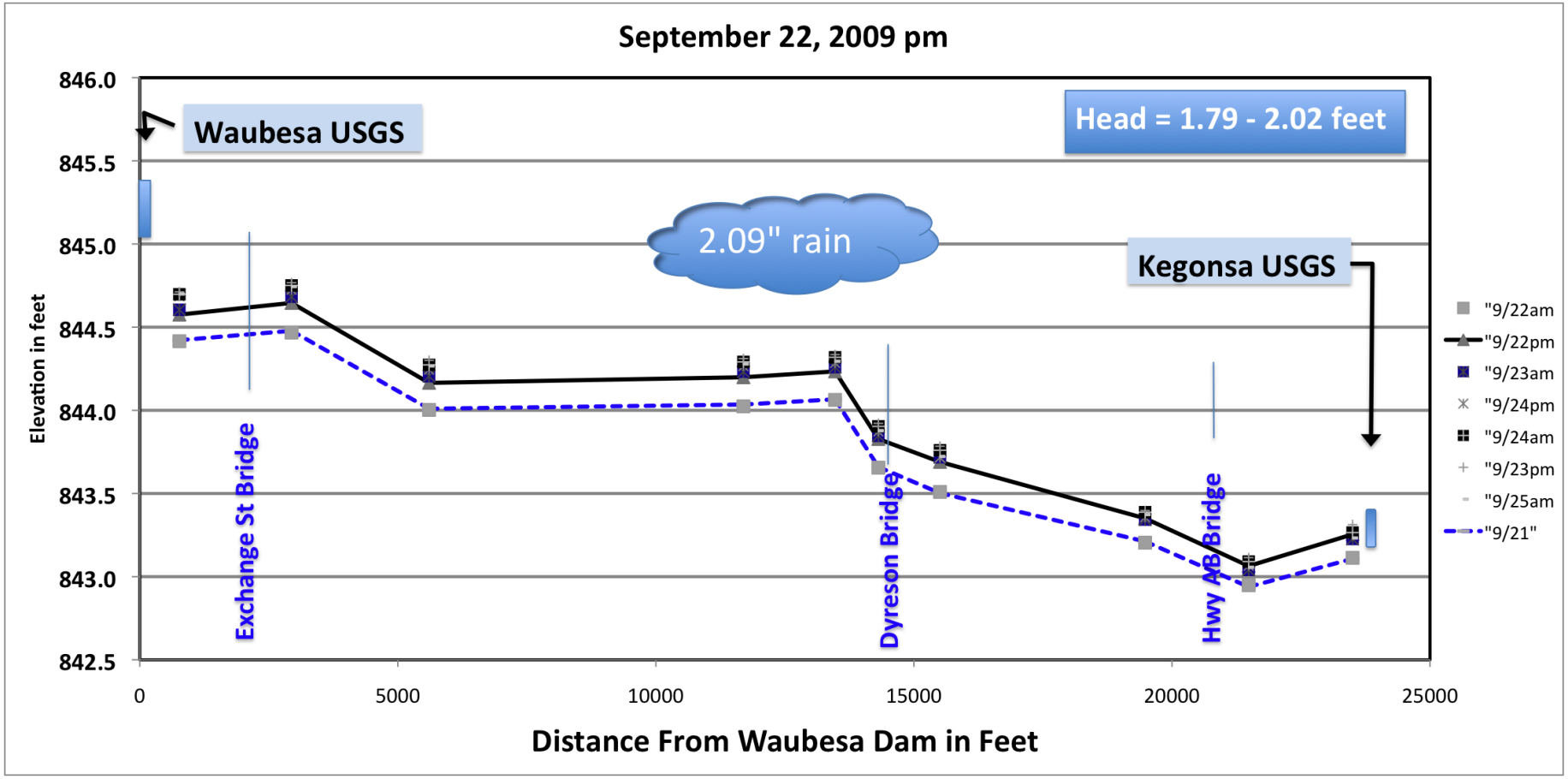
Rain Event

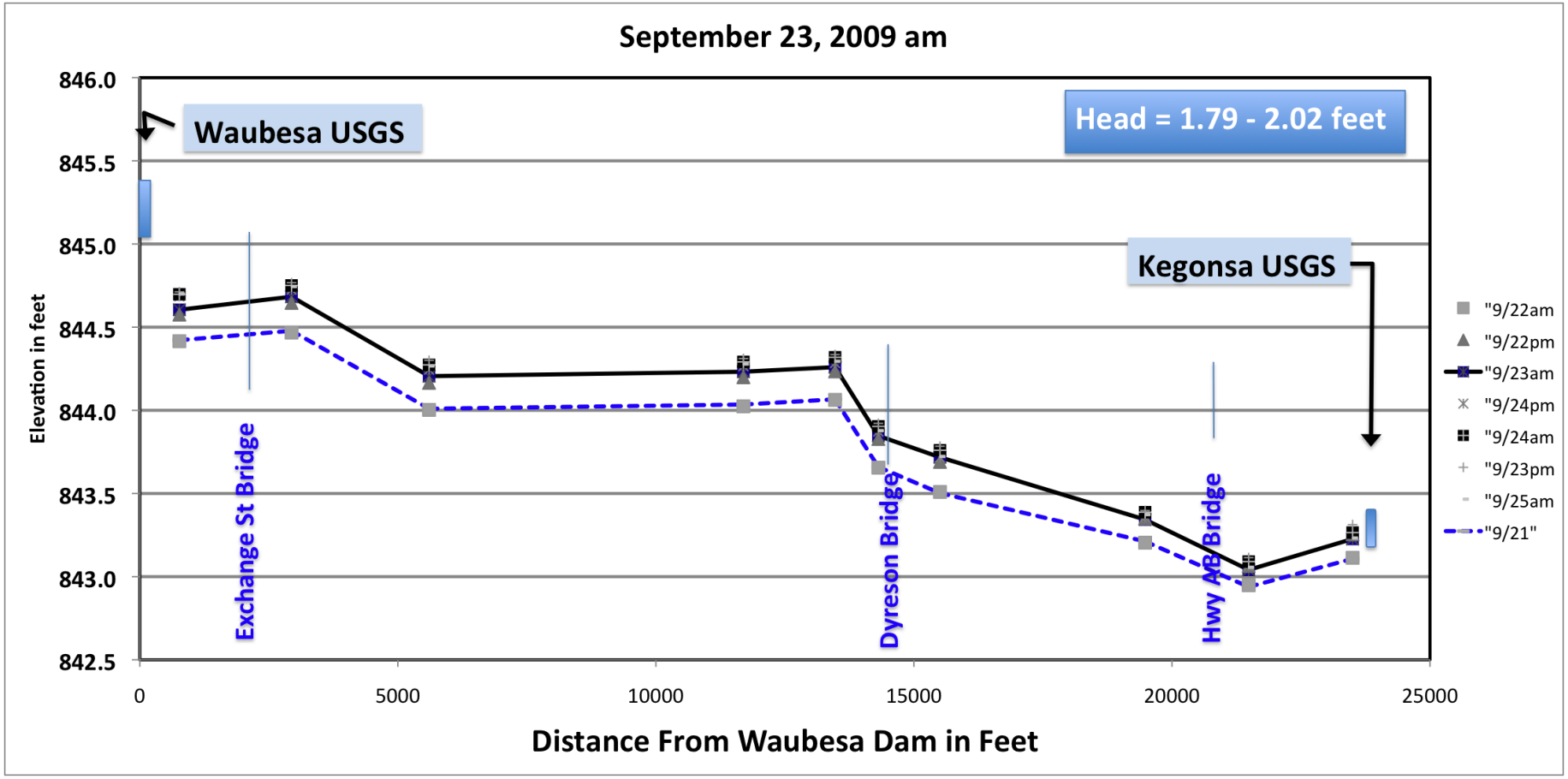
2.09 inches of rain on September 22

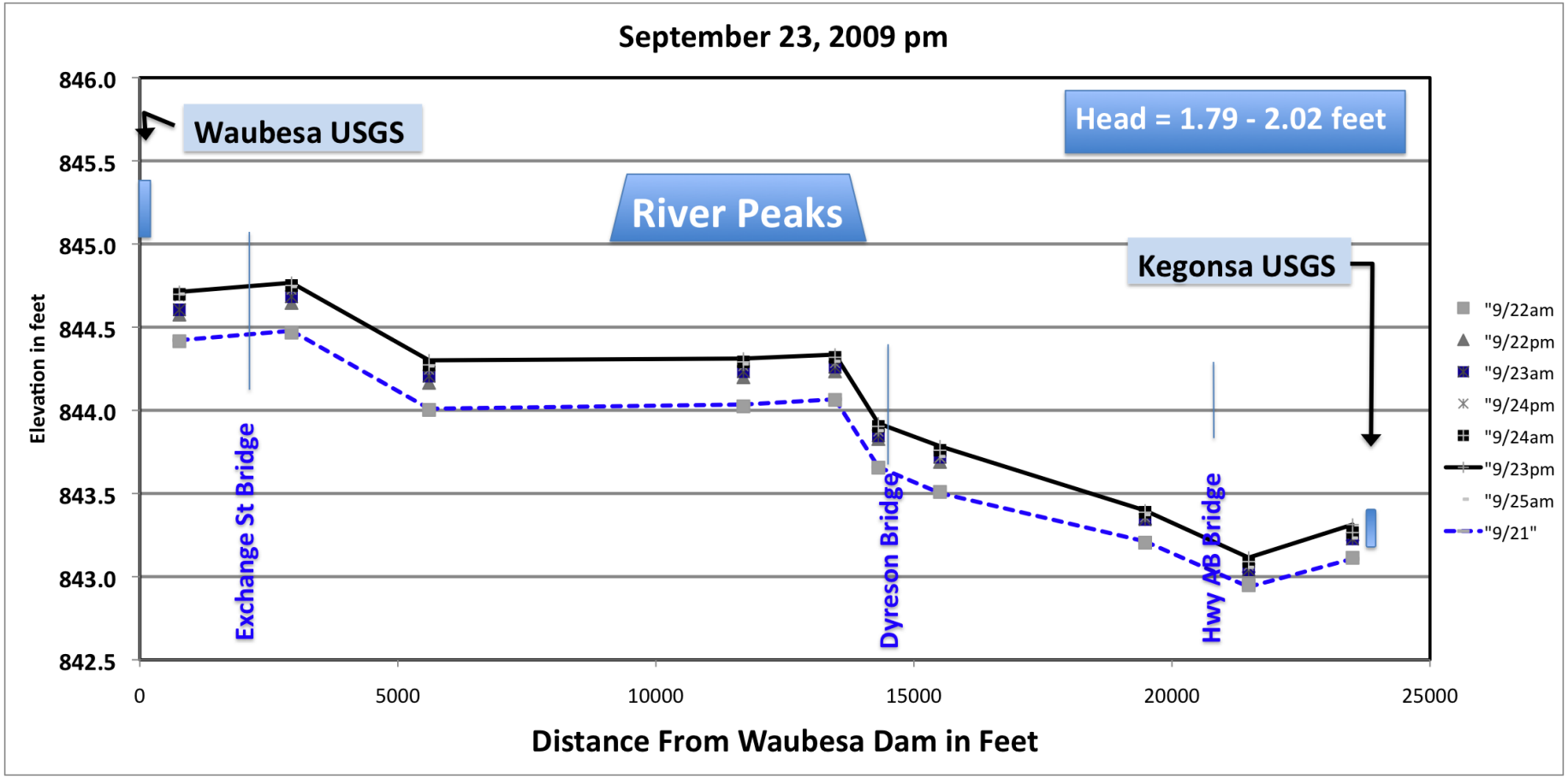
Half Day Means for Rain Event

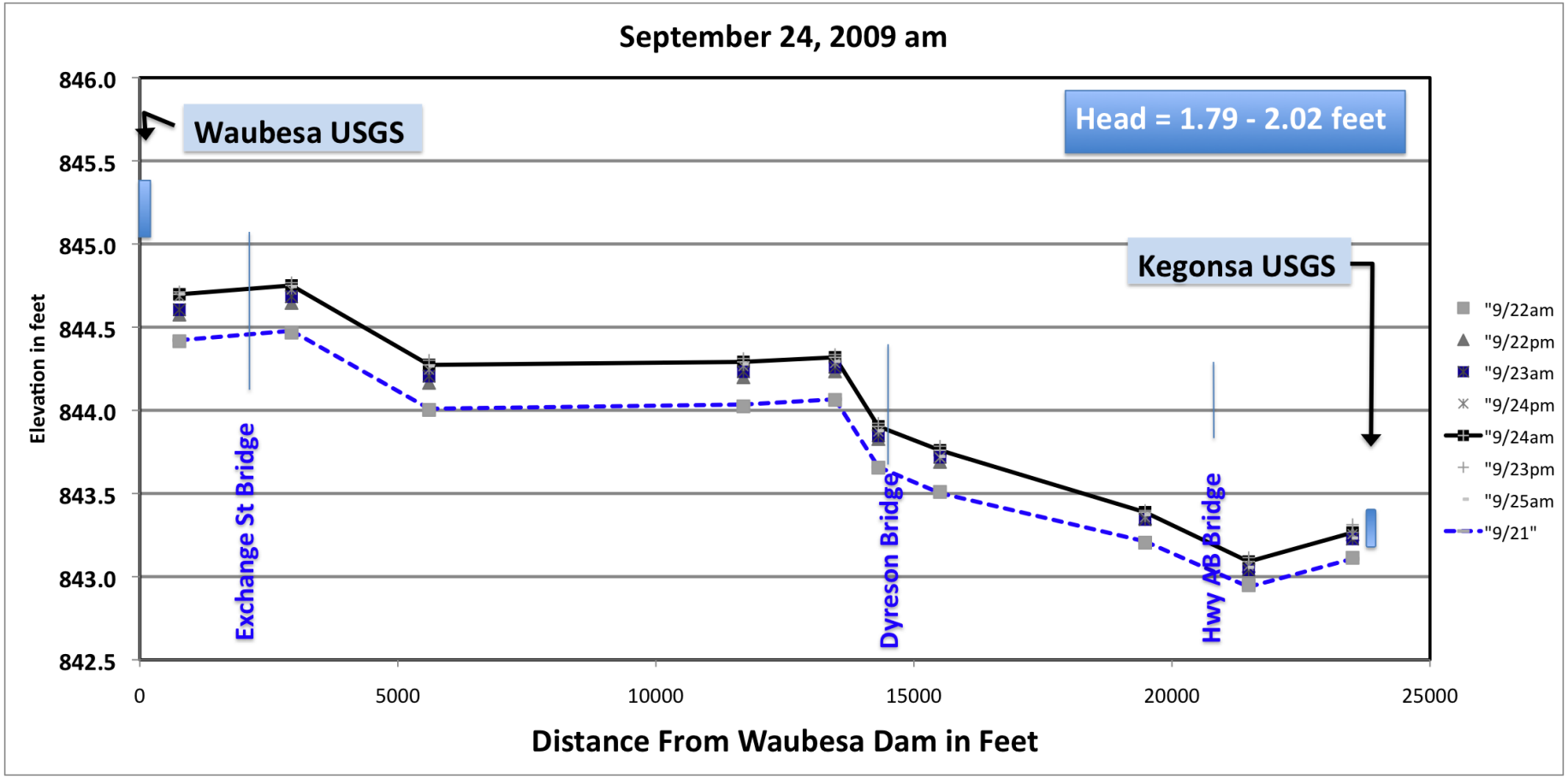


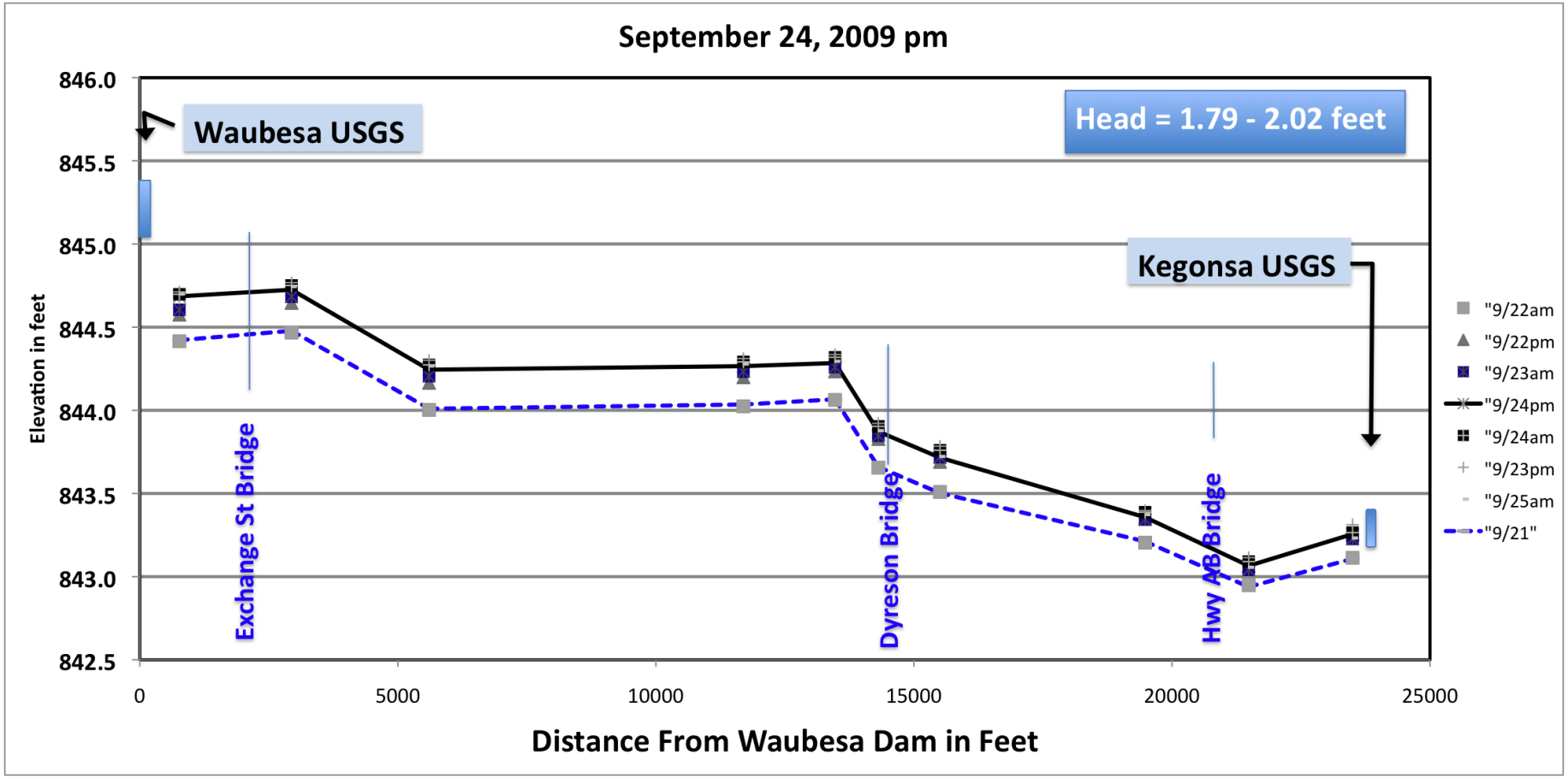

September 22, 2009 am
Waubesa USGS
Head = 1.79 - 2.02 feet
1.59" rain
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
Distance From Waubesa Dam in Feet
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"

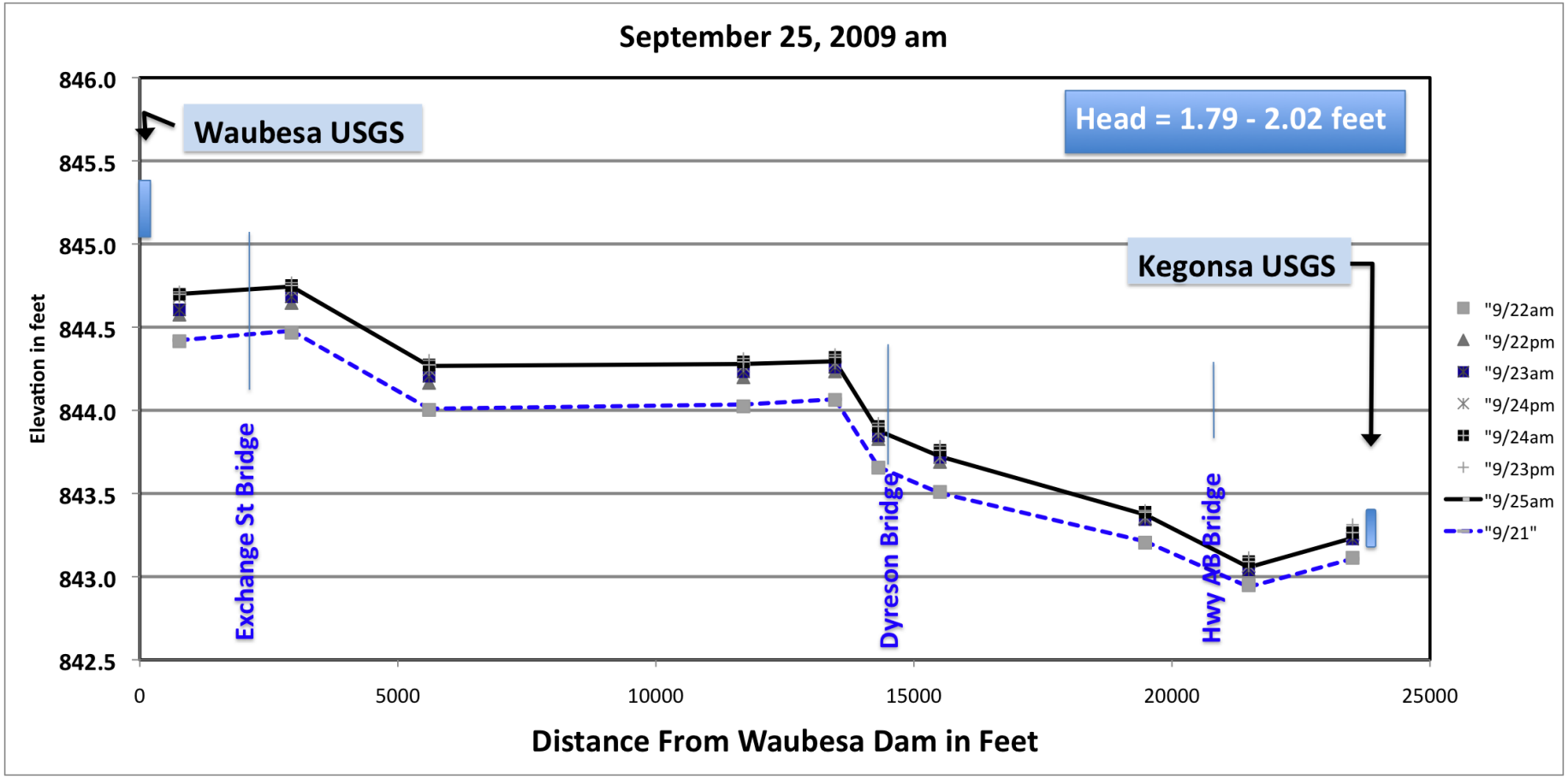

September 22, 2009 pm
Waubesa USGS
Head = 1.79 - 2.02 feet
2.09" rain
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
Distance From Waubesa Dam in Feet
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"

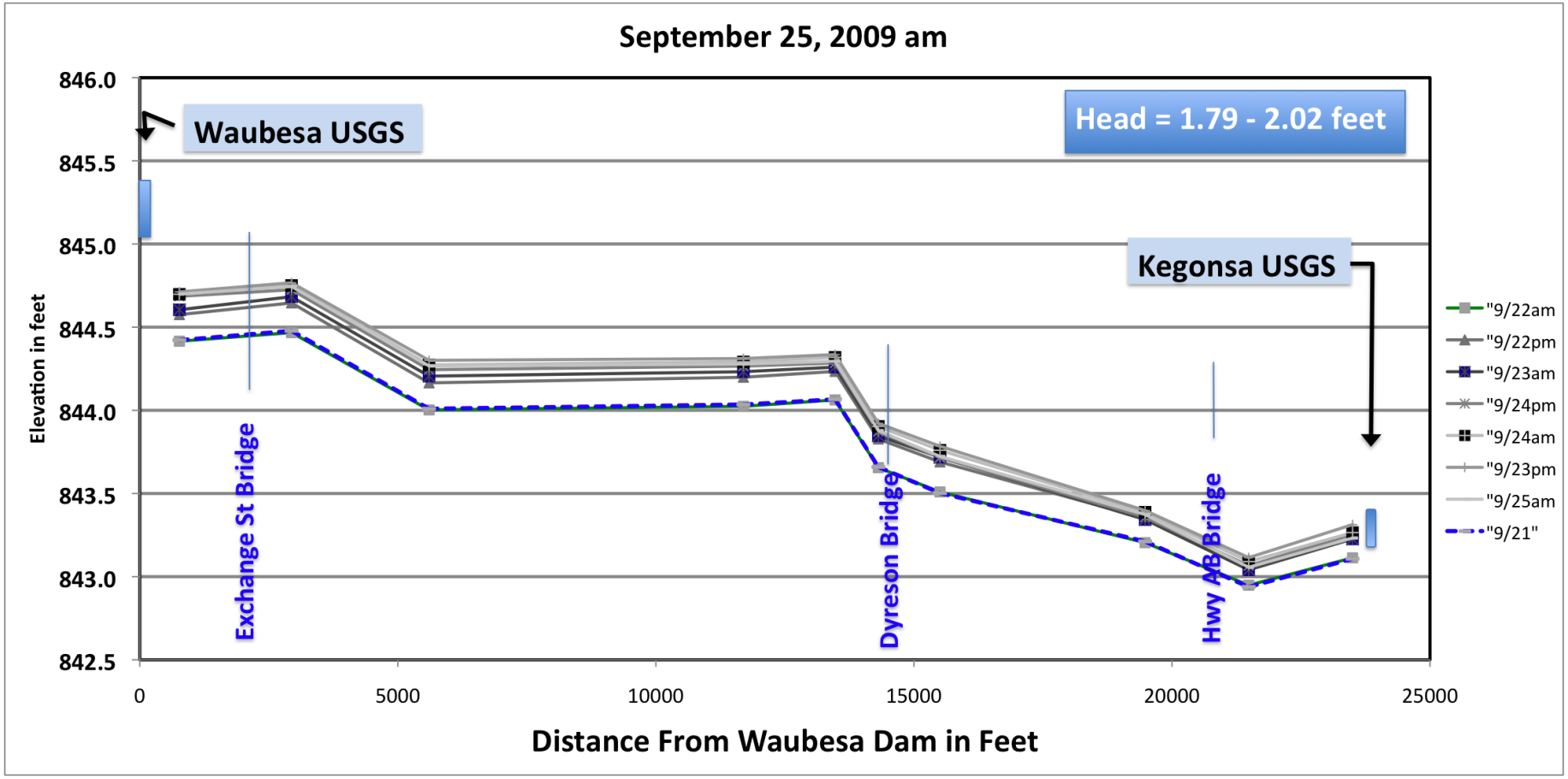

September 23, 2009 am
Waubesa USGS
Head = 1.79 - 2.02 feet
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
Distance From Waubesa Dam in Feet
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"

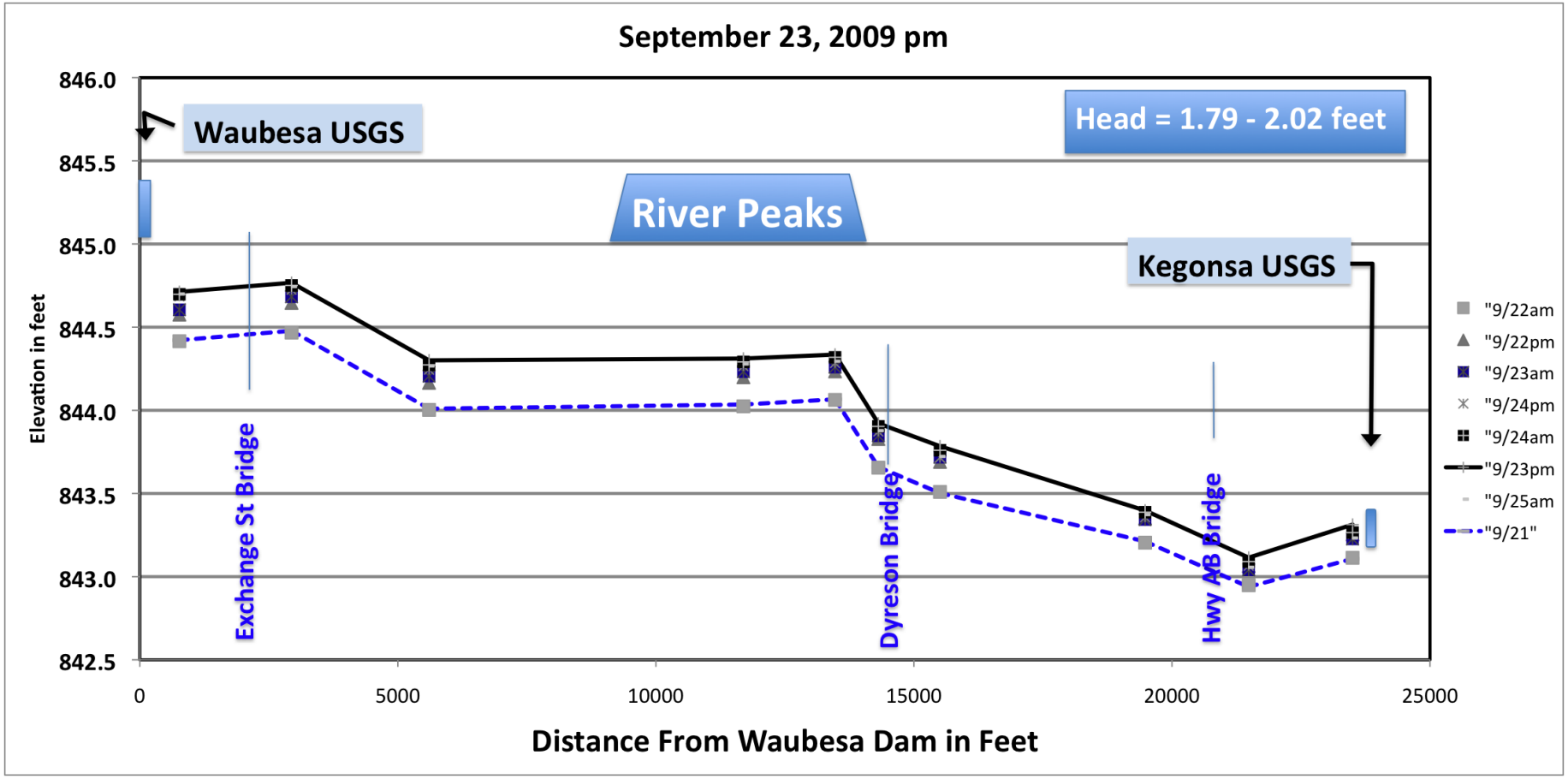

September 23, 2009 pm
Waubesa USGS
Head = 1.79 - 2.02 feet
River Peaks
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
Distance From Waubesa Dam in Feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"


September 24, 2009 am
Waubesa USGS
Head = 1.79 - 2.02 feet
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
Distance From Waubesa Dam in Feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"


September 24, 2009 pm
Waubesa USGS
Head = 1.79 - 2.02 feet
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
Distance From Waubesa Dam in Feet
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"


September 25, 2009 am
Waubesa USGS
Head = 1.79 - 2.02 feet
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
Distance From Waubesa Dam in Feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"


September 25, 2009 am
Waubesa USGS
Head = 1.79 - 2.02 feet
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
Distance From Waubesa Dam in Feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"


September 23, 2009 pm
Waubesa USGS
Head = 1.79 - 2.02 feet
River Peaks
Kegonsa USGS
Exchange St Bridge
Dyreson Bridge
Hwy AB Bridge
Elevation in feet
Distance From Waubesa Dam in Feet
846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
0
5000
10000
15000
20000
25000
"9/22am
"9/22pm
"9/23am
"9/24pm
"9/24am
"9/23pm
"9/25am
"9/21"

Transducer Study Observations

Summary

- The data indicate that the slope of the river is substantially different at different points along the river
- The profile of the river appears to change during rain events
- More data is needed at “points of interest” to more fully explain the profile

Follow-up GPS Study

November 19, 2009

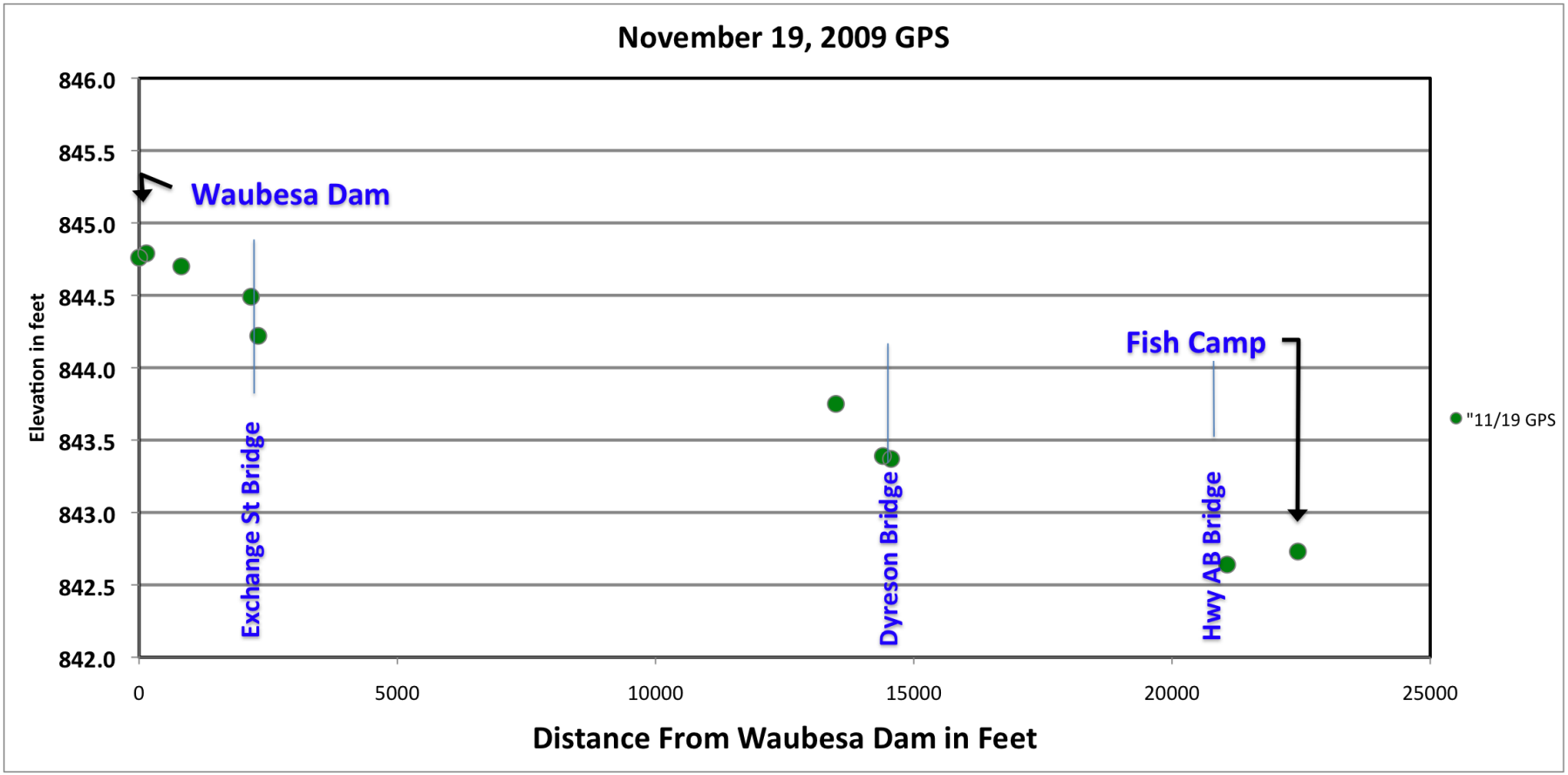
GPS Study Objectives

- Investigate river elevations near the Waubesa Dam
- Obtain additional data near Exchange St. bridge
- Obtain additional data near Dyreson bridge
- Obtain additional data near Hwy AB bridge

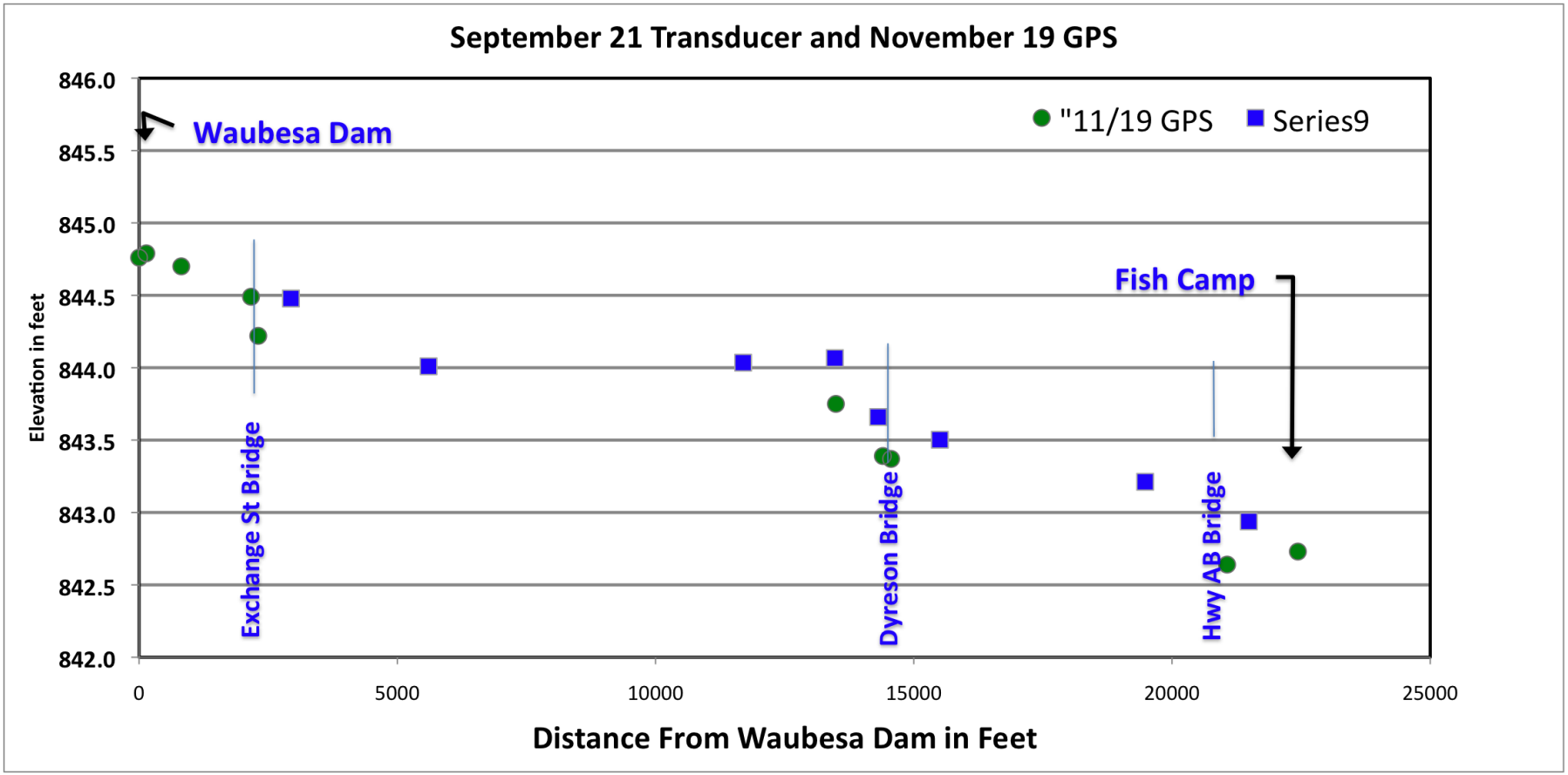
GPS Study

Same surveyor and equipment used in original study

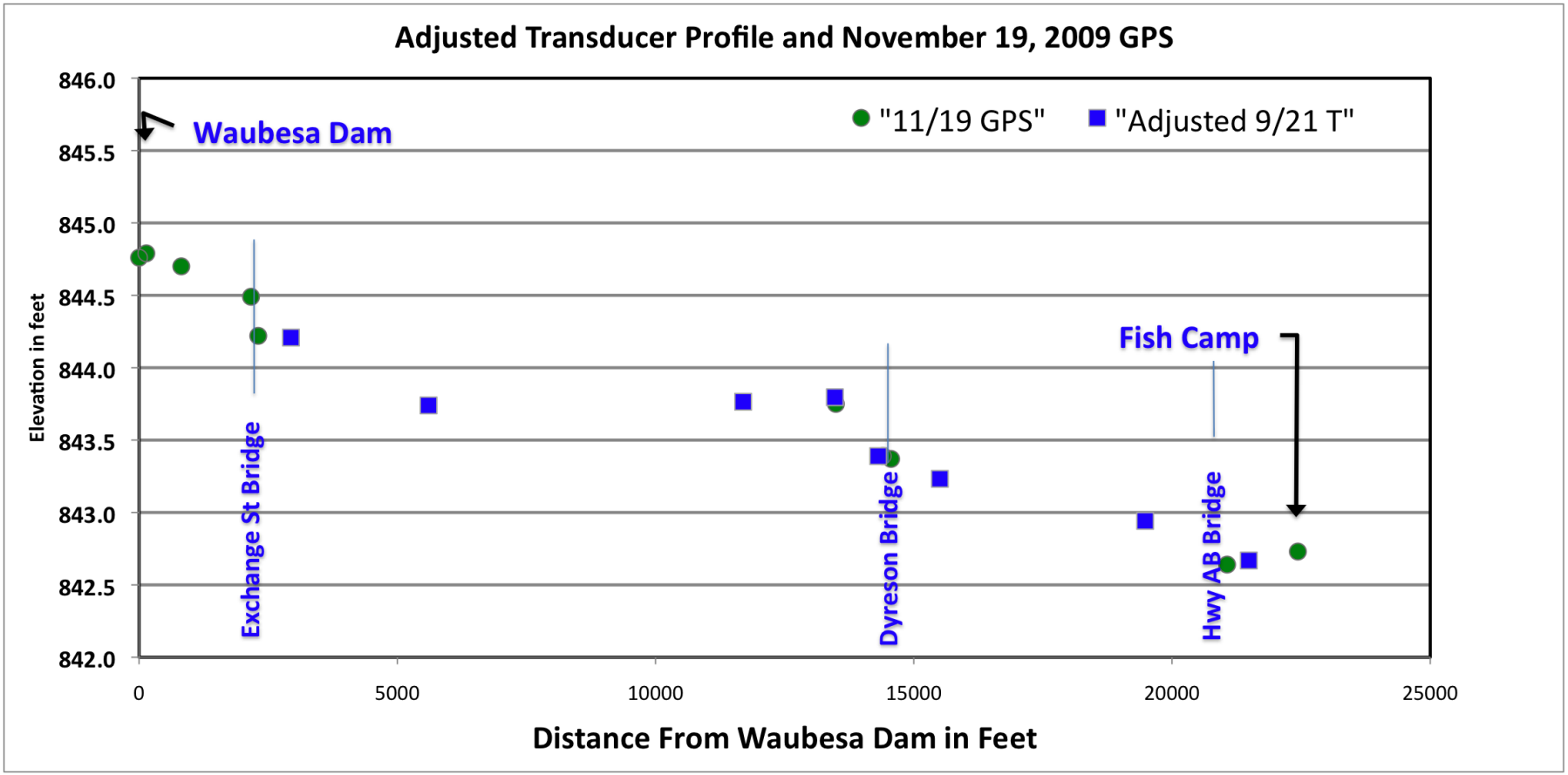
November 19 GPS Survey Data

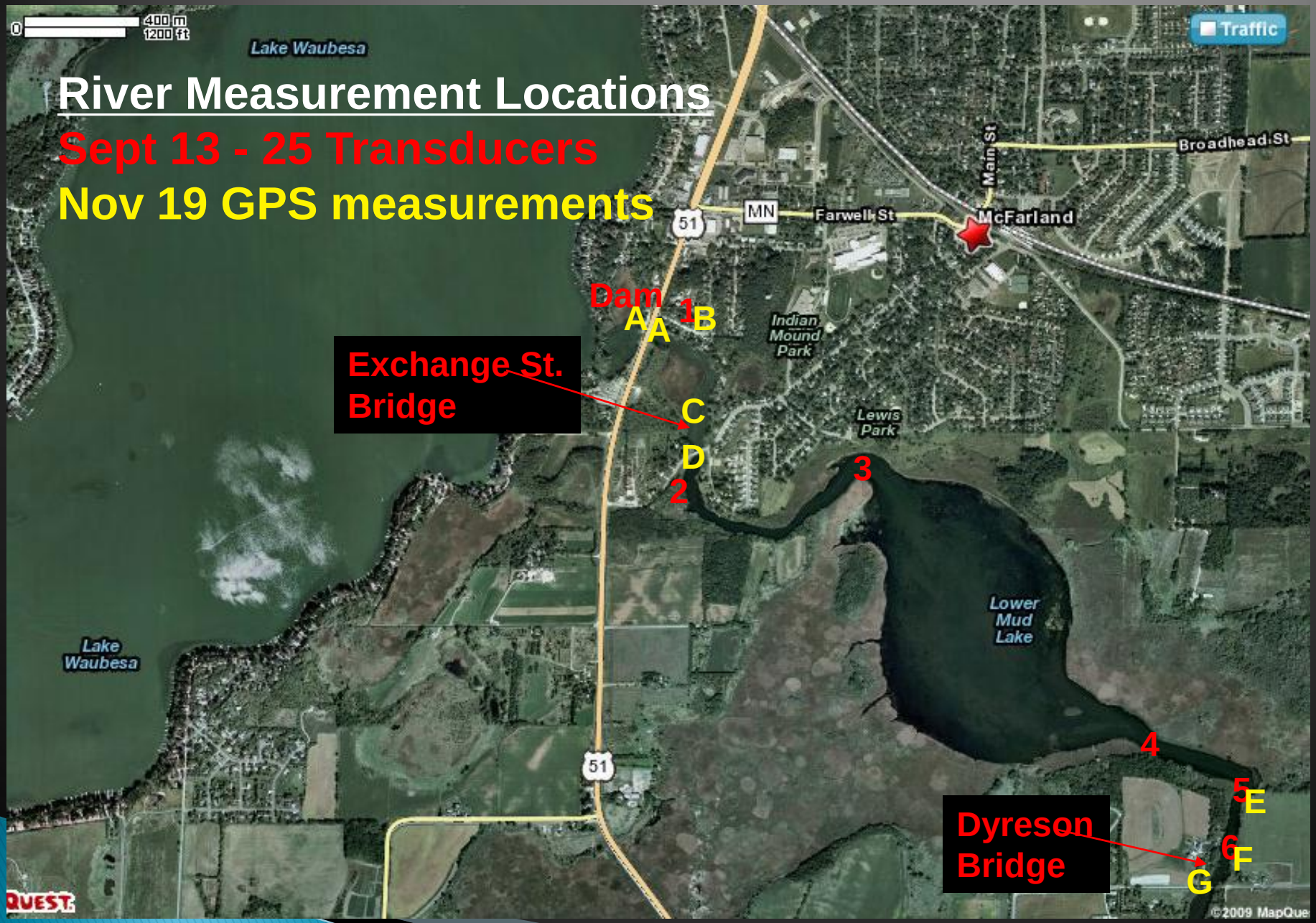


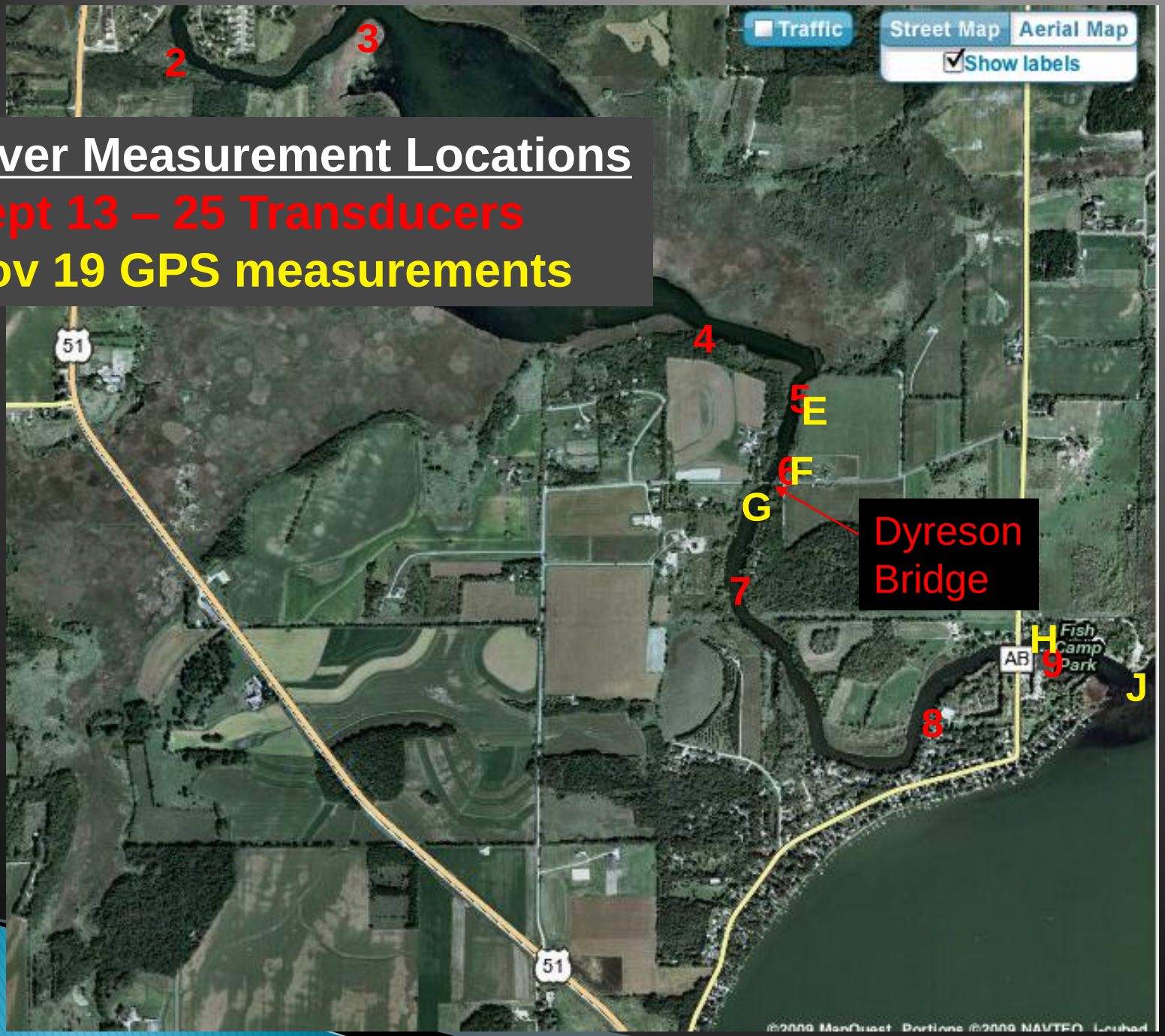
GPS Survey and Transducer Data



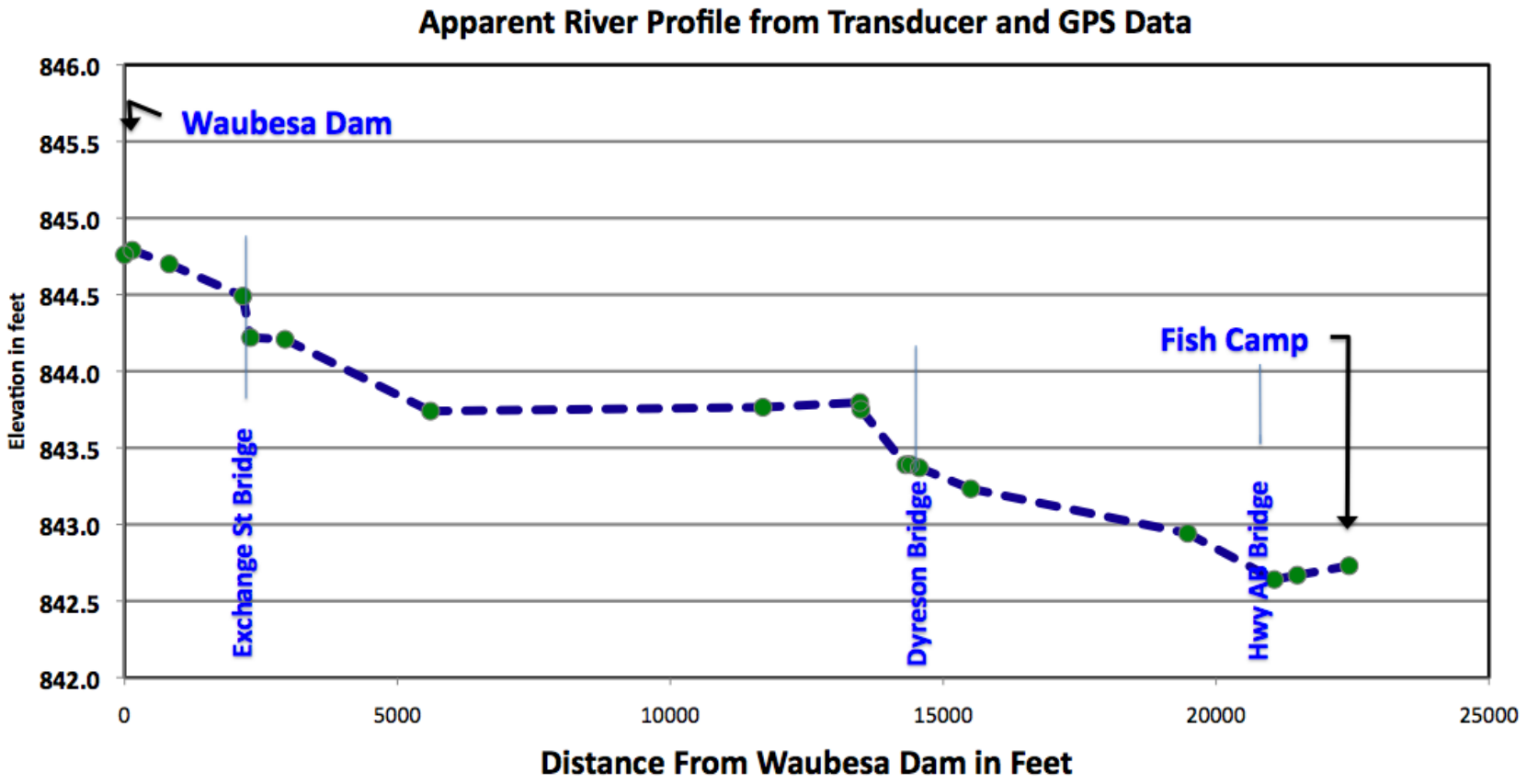
GPS and Adjusted Transducer Data




River Measurement Locations
Sept 13 - 25 Transducers
Nov 19 GPS measurements
Lake Waubesa
Traffic
Main St
Broadhead St
MN
Farwell St
McFarland
51
Dam
A
A
1
B
Indian Mound Park
Exchange St. Bridge
C
D
2
Lewis Park
3
Lower Mud Lake
Lake Waubesa
51
4
5
E
6
F
G
Dyreson Bridge
©2009 MapQuest


Traffic
Street Map
Aerial Map
Show labels
River Measurement Locations
Sept 13 – 25 Transducers
Nov 19 GPS measurements
2
3
4
5
E
6
F
G
Dyreson Bridge
7
H
9
J
8
51
51
AB
Fish Camp Park

Apparent Profile of River



Interesting Information Noted

Date	9/13/09	9/21/09	9/23/09 (after rain)	11/19/09	
Waubesa Elevation	845.20	845.07	845.31	844.94	
Kegonsa Elevation	843.16	843.22	843.36	842.98	
Head (diffs)	2.04	1.85	1.95	1.96	
Waubesa Discharge (ft3/sec)	130	142	202	392	
Exchange St Discharge (ft3/sec)	114	121	na	420	

Possible Next Steps

- Look at data more closely to identify possible issues
- Look at data more closely to identify possible river profile change over time
- Conduct detailed elevation and flow studies at potential problem locations