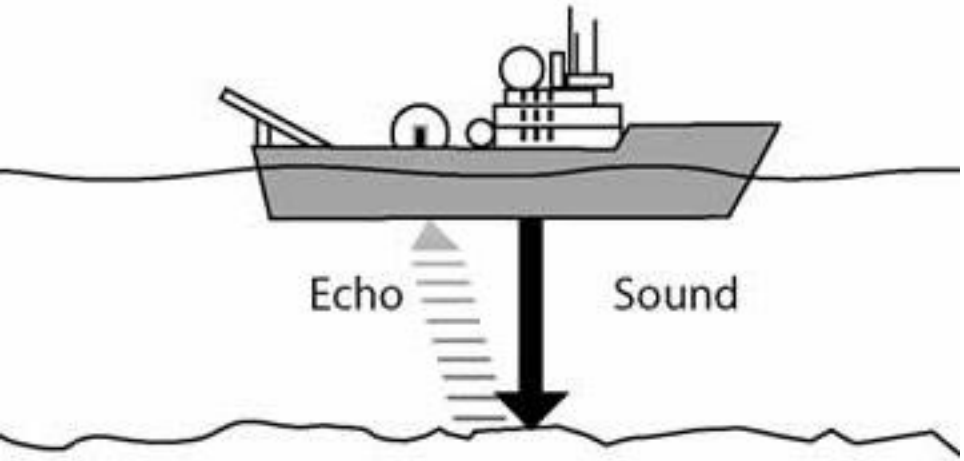
Automating Common Geomorphic Analyses with the XSViewer

John Shelley, Ph.D., P.E.

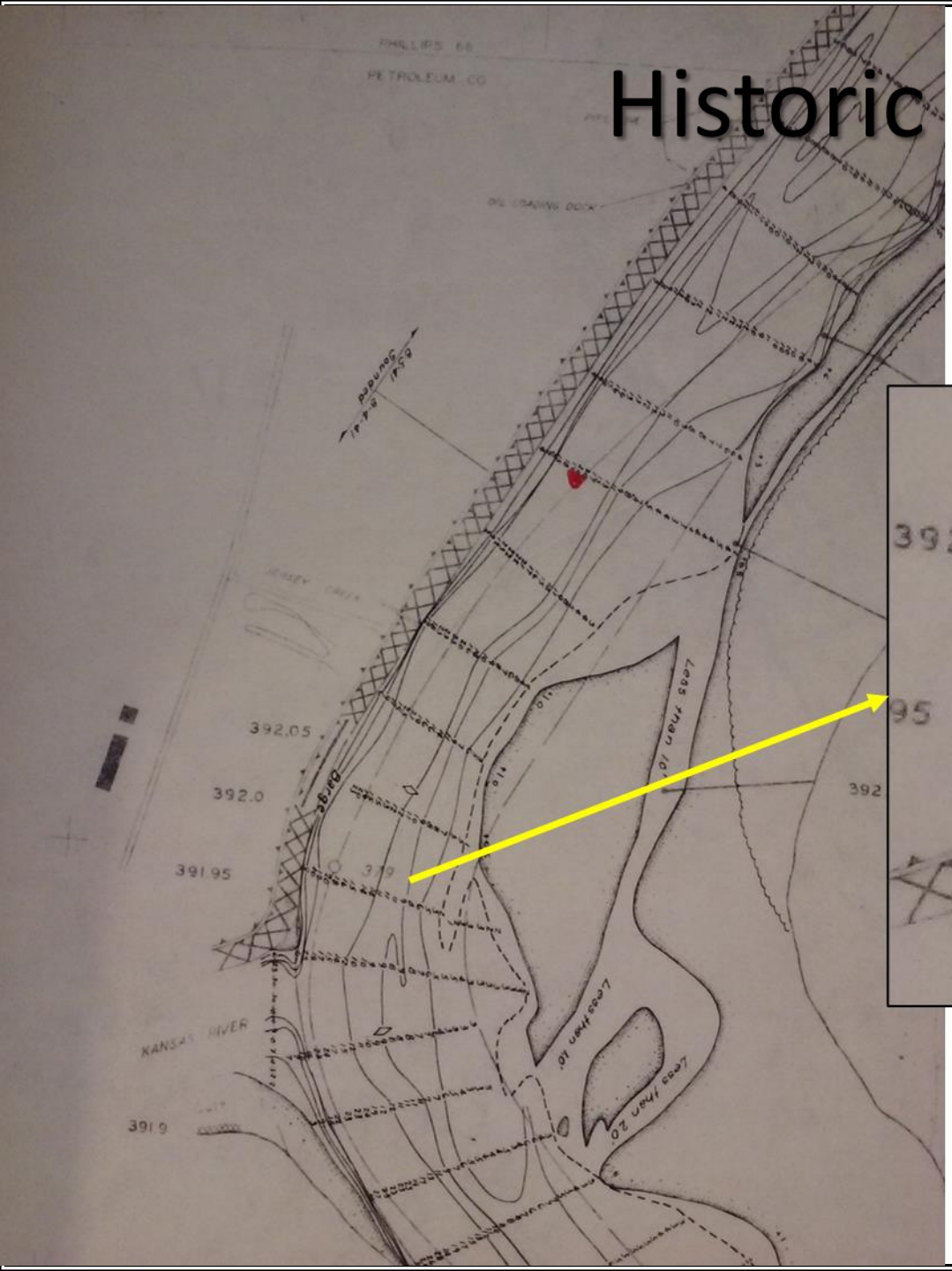
Outline

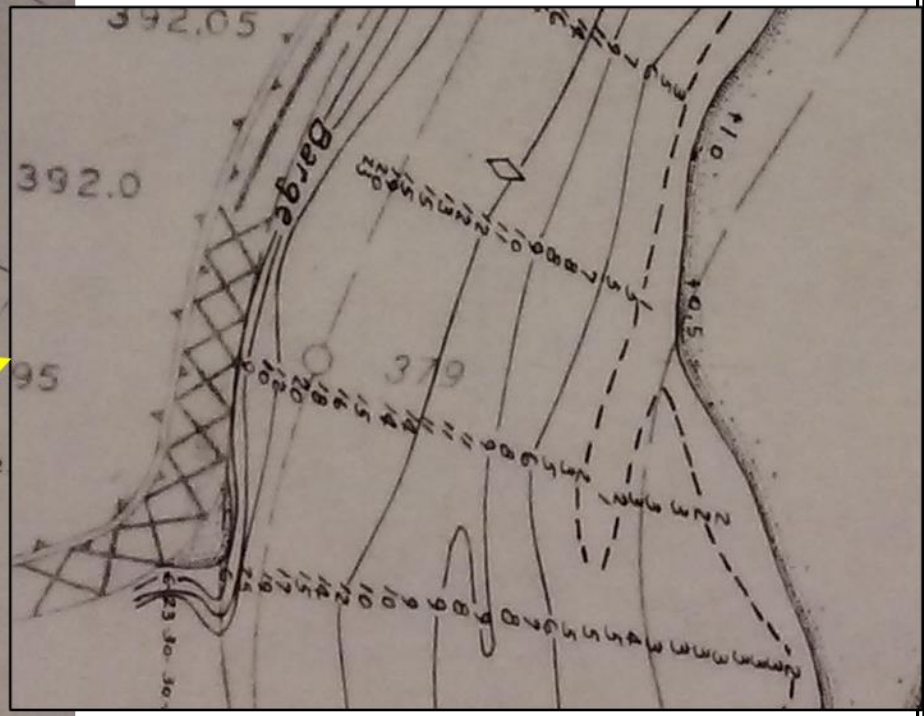
- Cross sections
- Best Practices in XS Analysis
- The XSViewer
  - Plot XS
  - Compute volume change
  - Compute average bed elevation change
  - Compute depth distribution
  - Long profile plotter
  - Selection sets for QA/QC

Low-Tech and Cheap



Historic Comparison





1940 Missouri River Hydrographic Survey

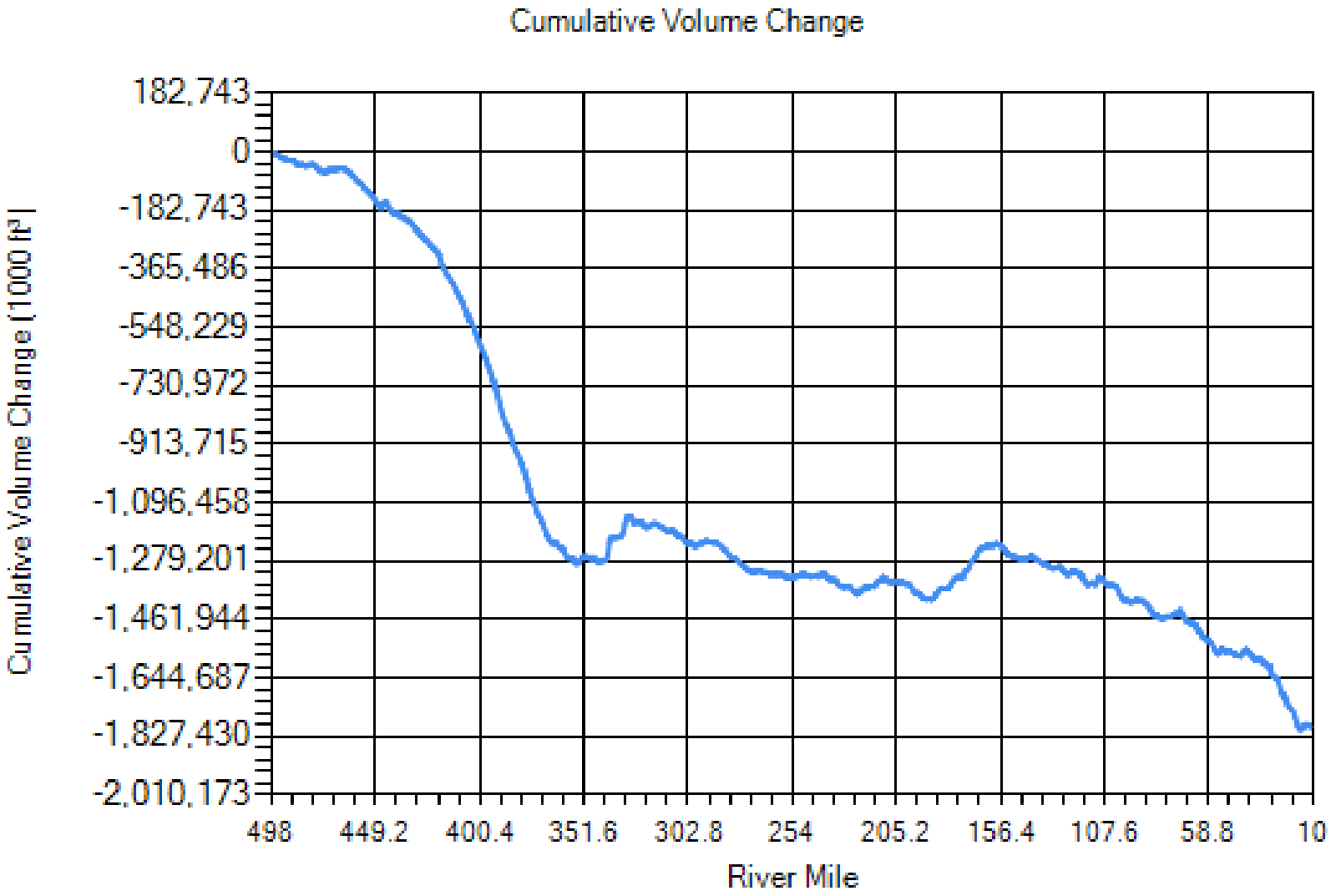
Cross Sections Sources

- Paper mapbooks and old reports
- Degradation rangelines downstream from dams
- FEMA floodplain studies
- Permits (stream crossings, bridges, etc.)
- Old RAS, HEC-2, and HEC-6 studies
- Levee studies
- LIDAR

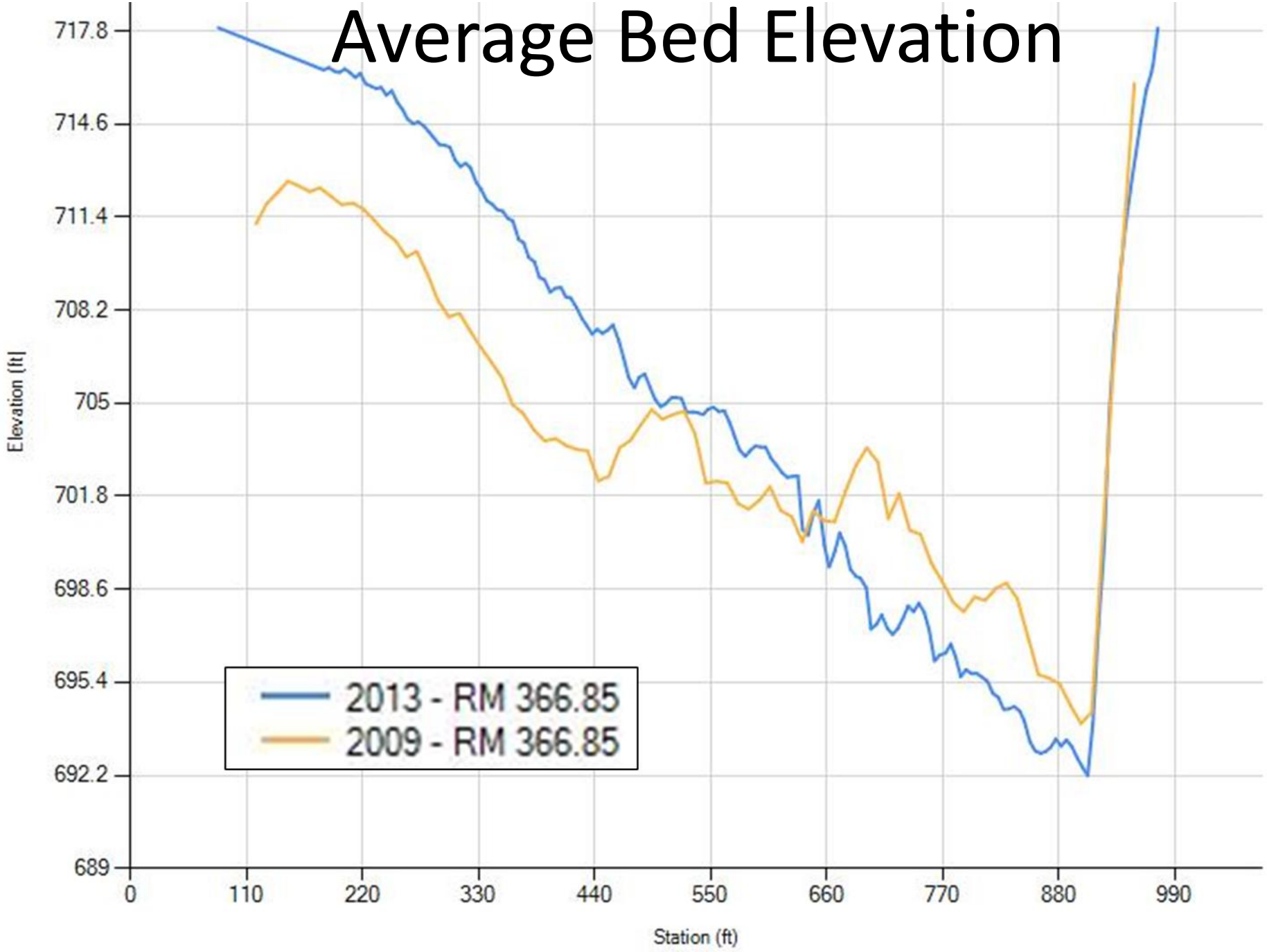
Outline

- Cross sections
- **Best Practices in XS Analysis**
- The XSViewer
  - Plot XS
  - Compute volume change
  - Compute average bed elevation change
  - Compute depth distribution
  - Long profile plotter
  - Selection sets for QA/QC

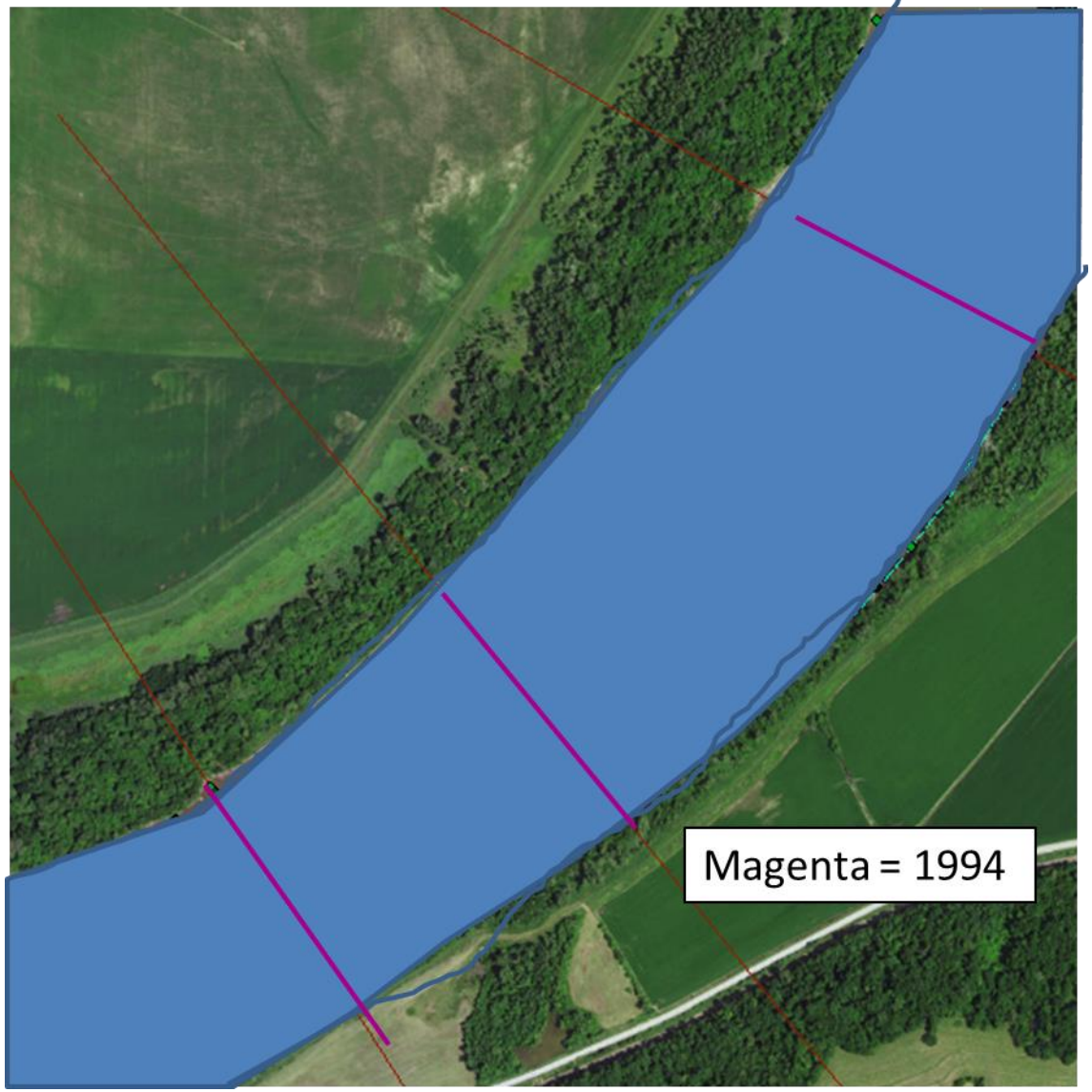
Longitudinal Cumulative Volume Change Curve



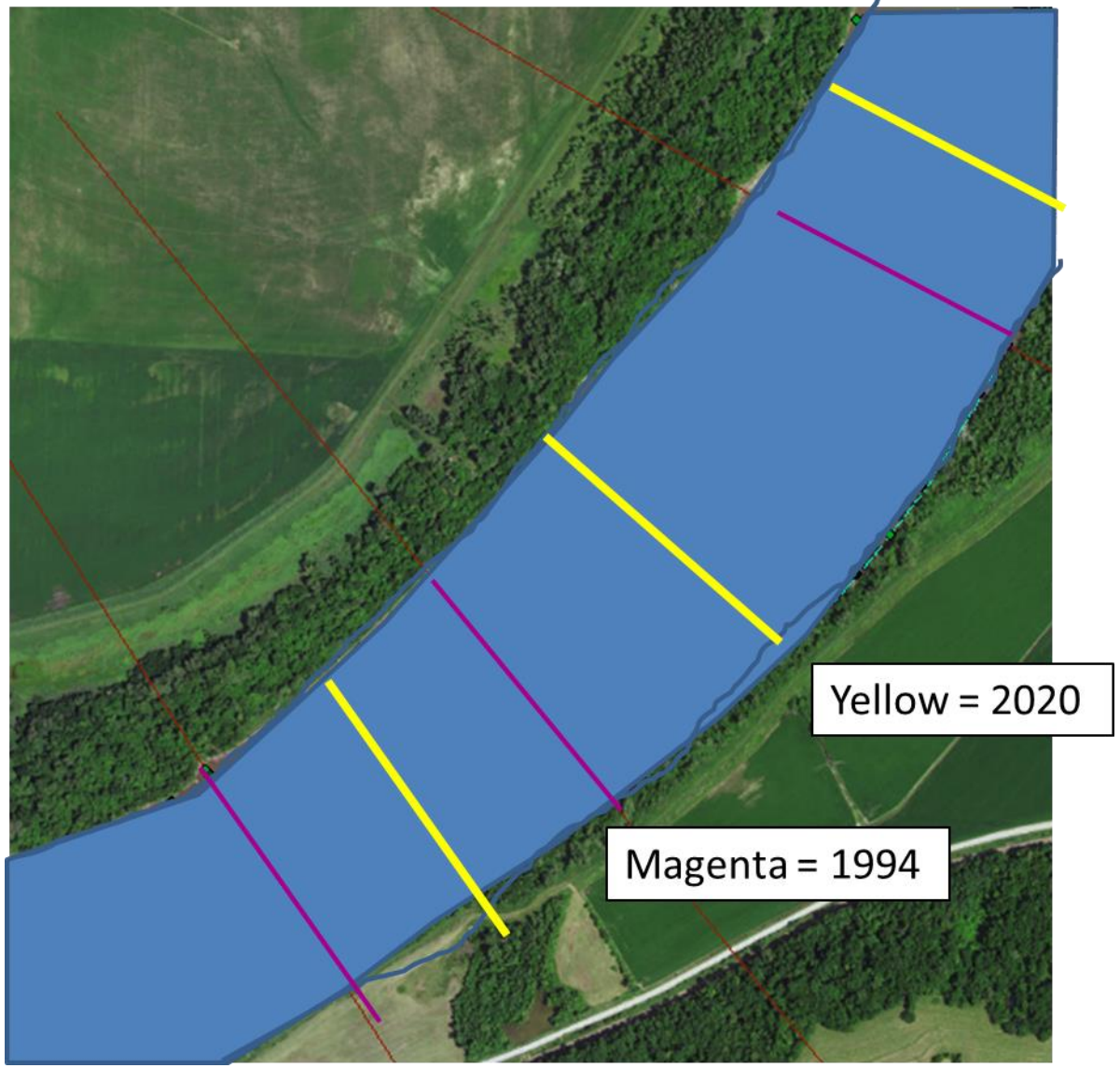
Average Bed Elevation



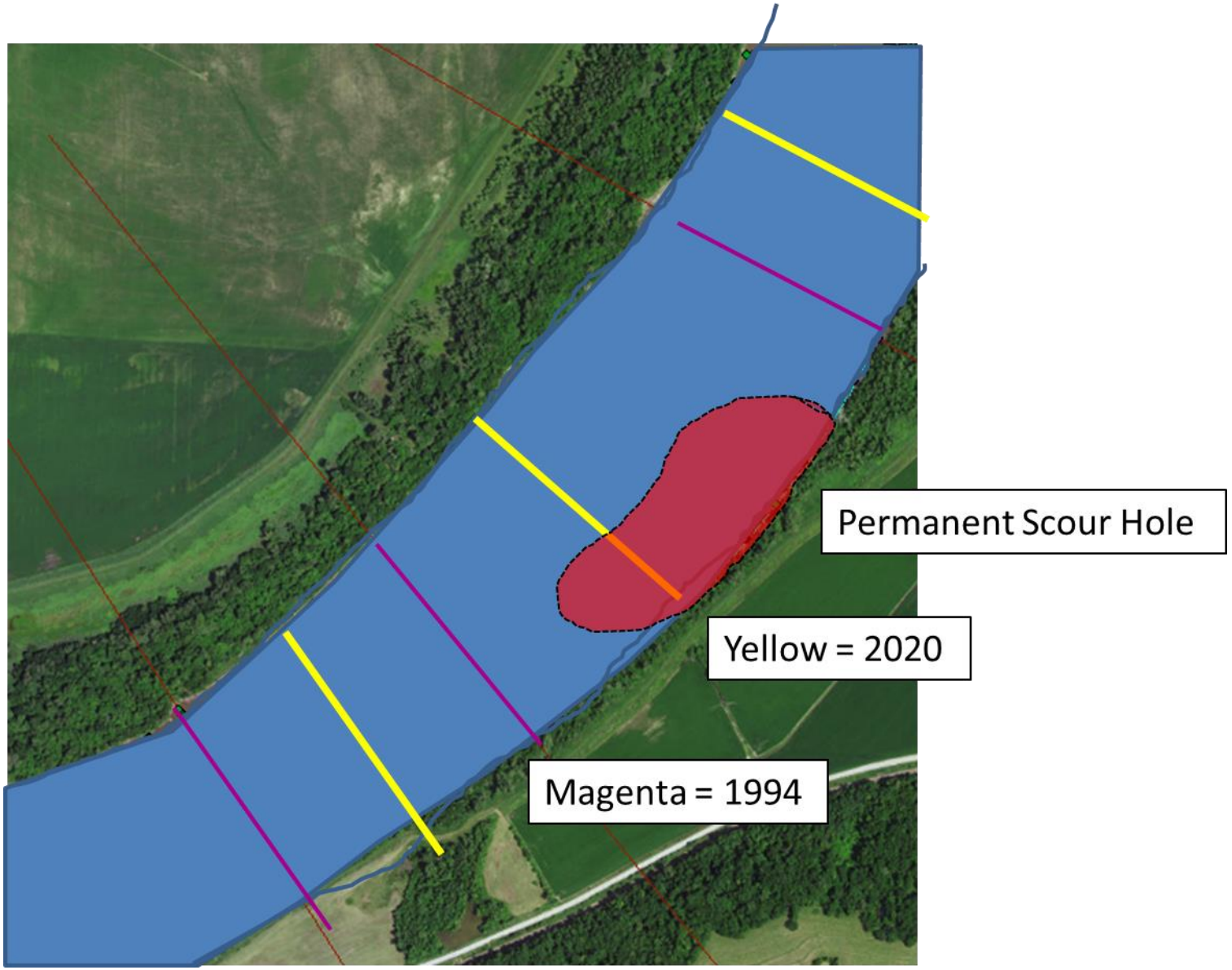
Collection on Historic Lines



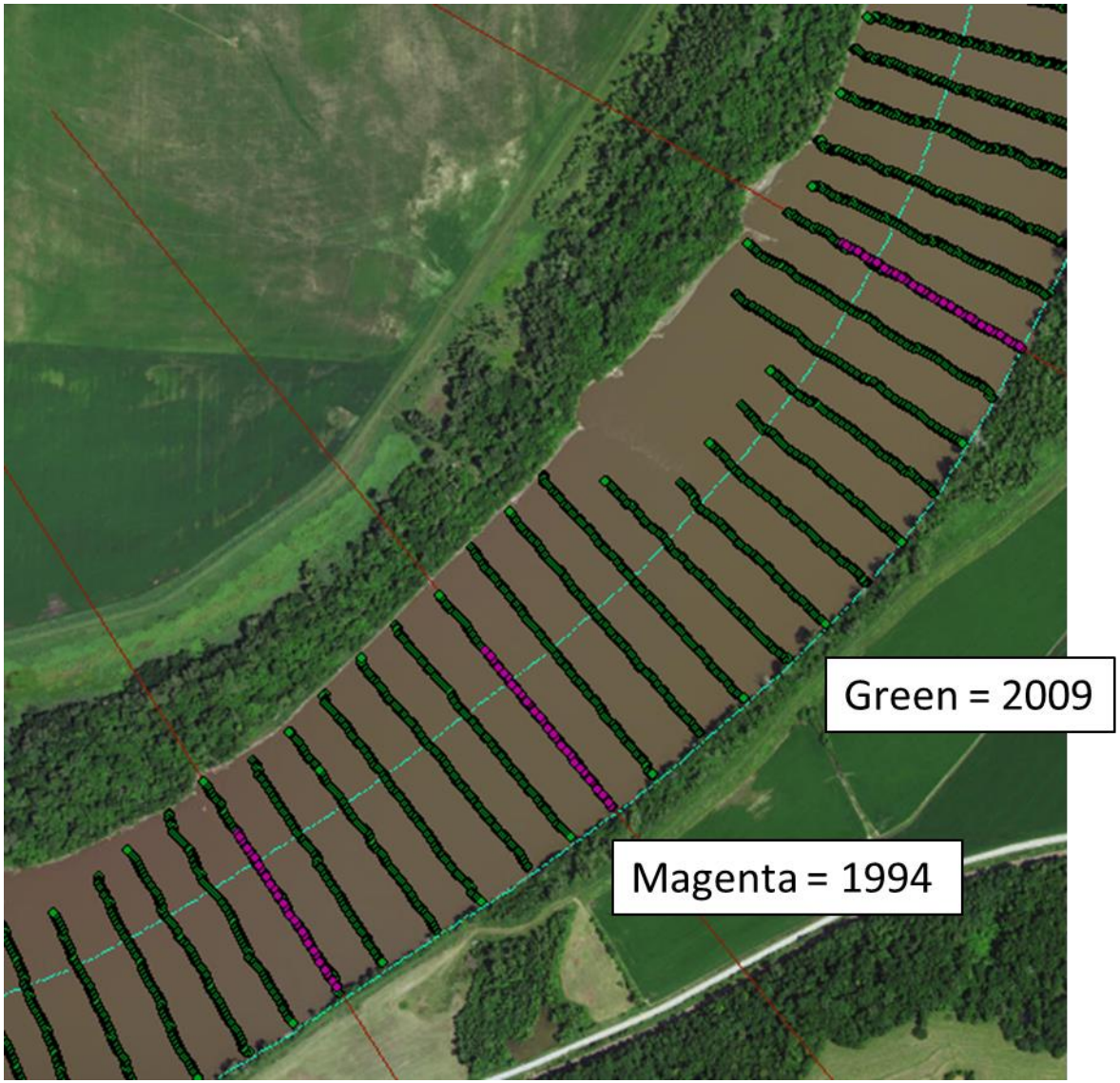
Collection on Historic Lines



Collection on Historic Lines



Comparing XS at Similar Locations



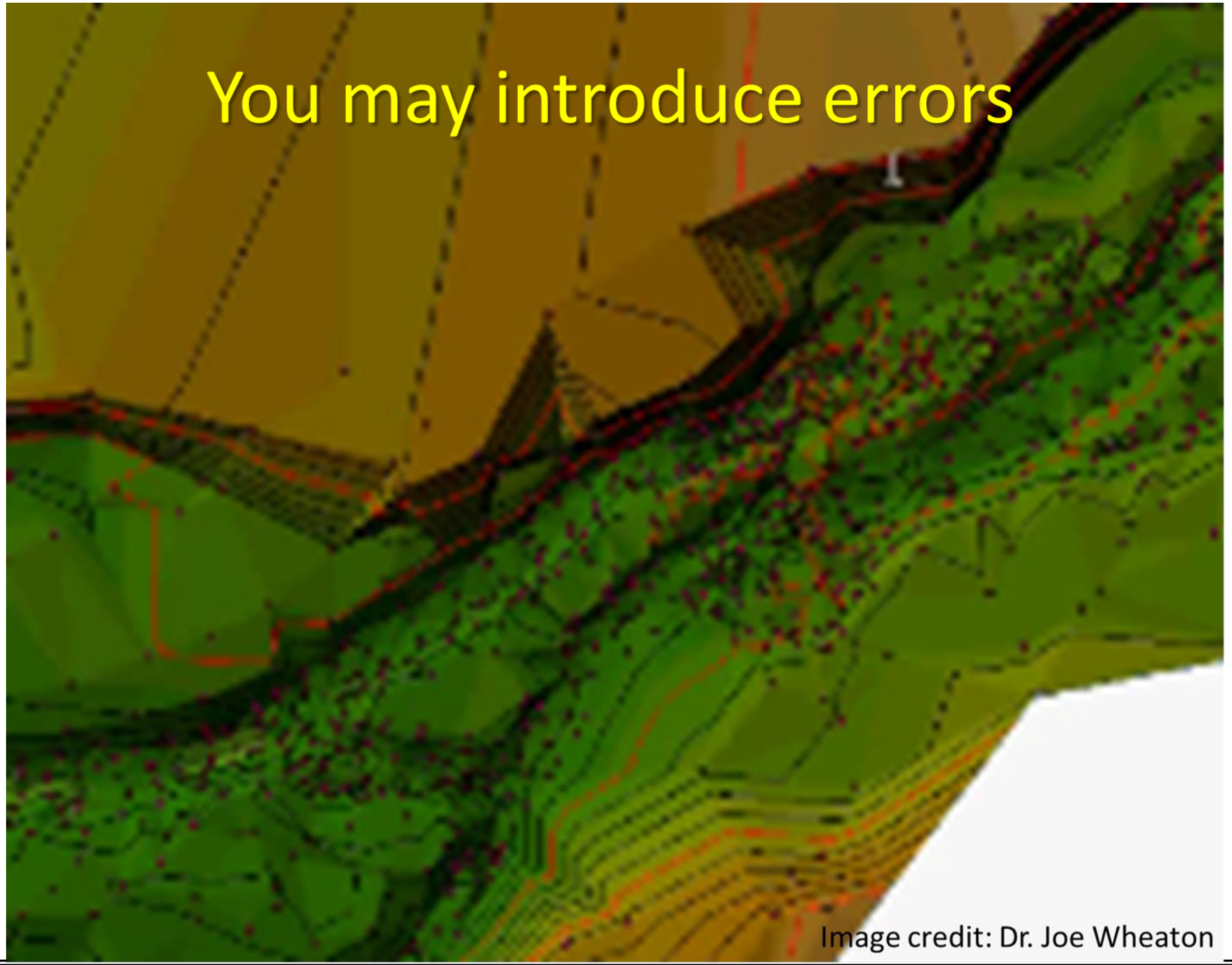
Should I build a surface from each data set and compare using ArcGIS?

Should I build a surface from each data set and compare using ArcGIS?

No

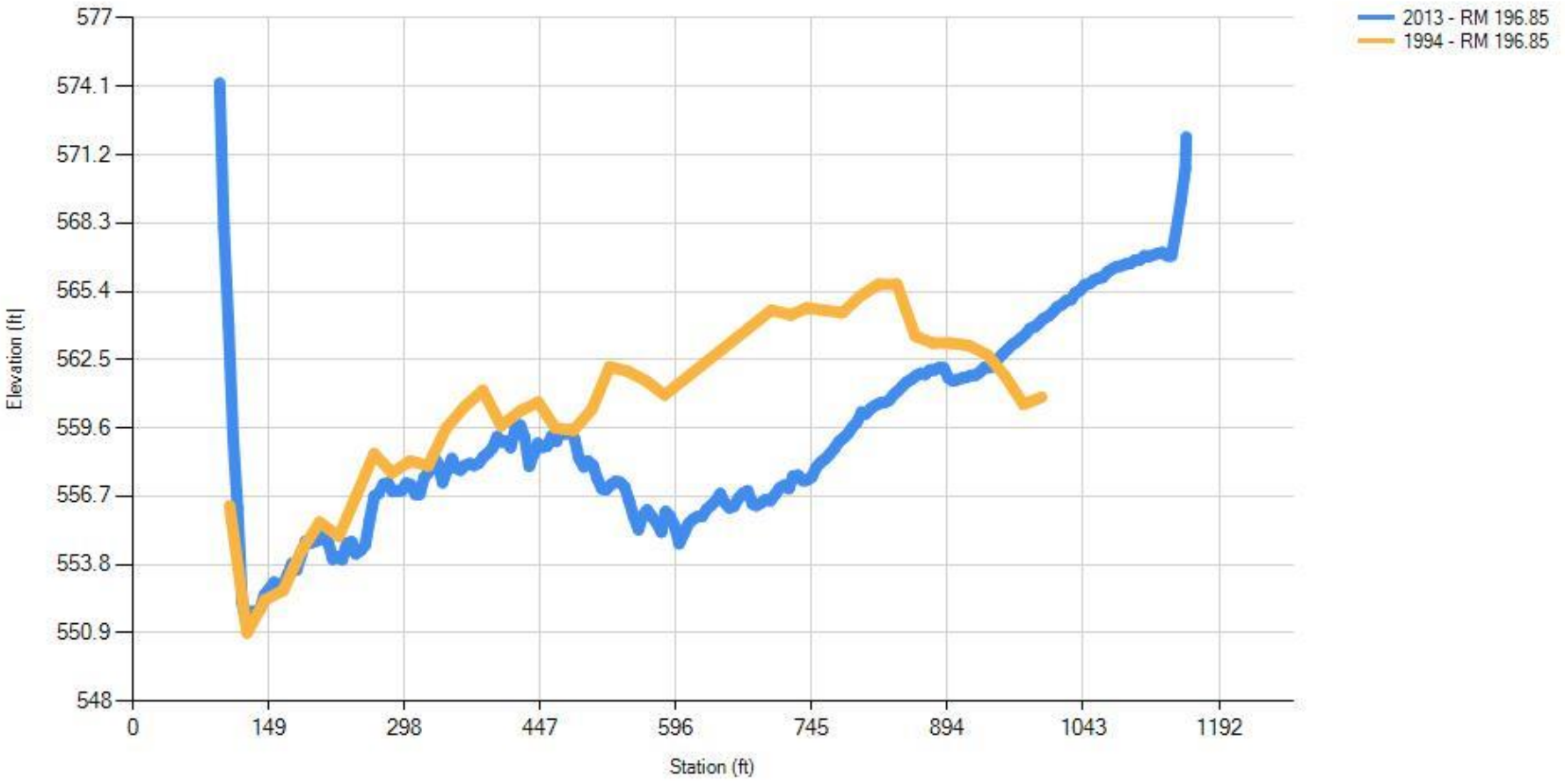
Should I build a surface from each data set and compare using ArcGIS?

No!!!


You may introduce errors
Image credit: Dr. Joe Wheaton

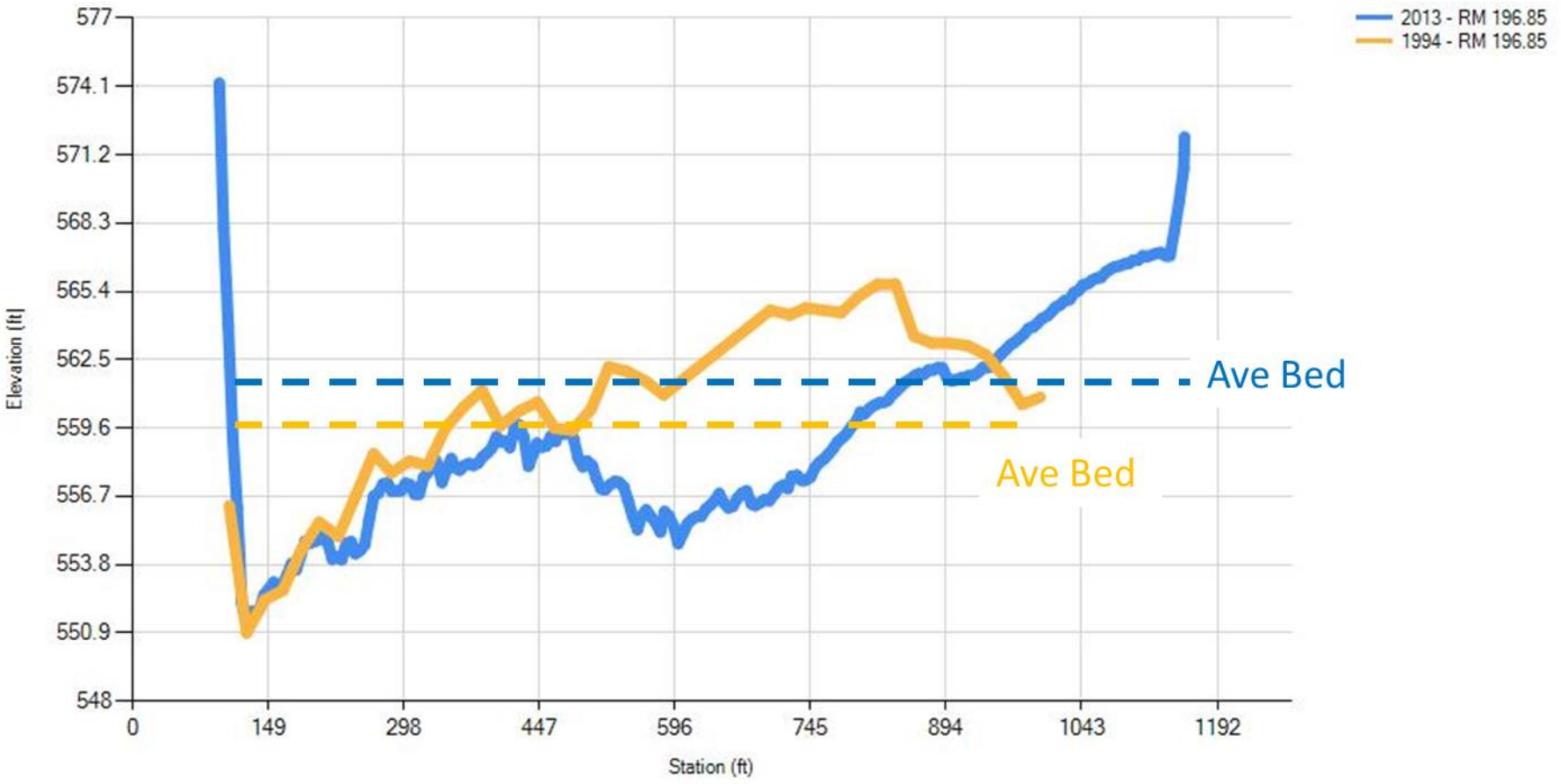
Build a surface?

Consistency

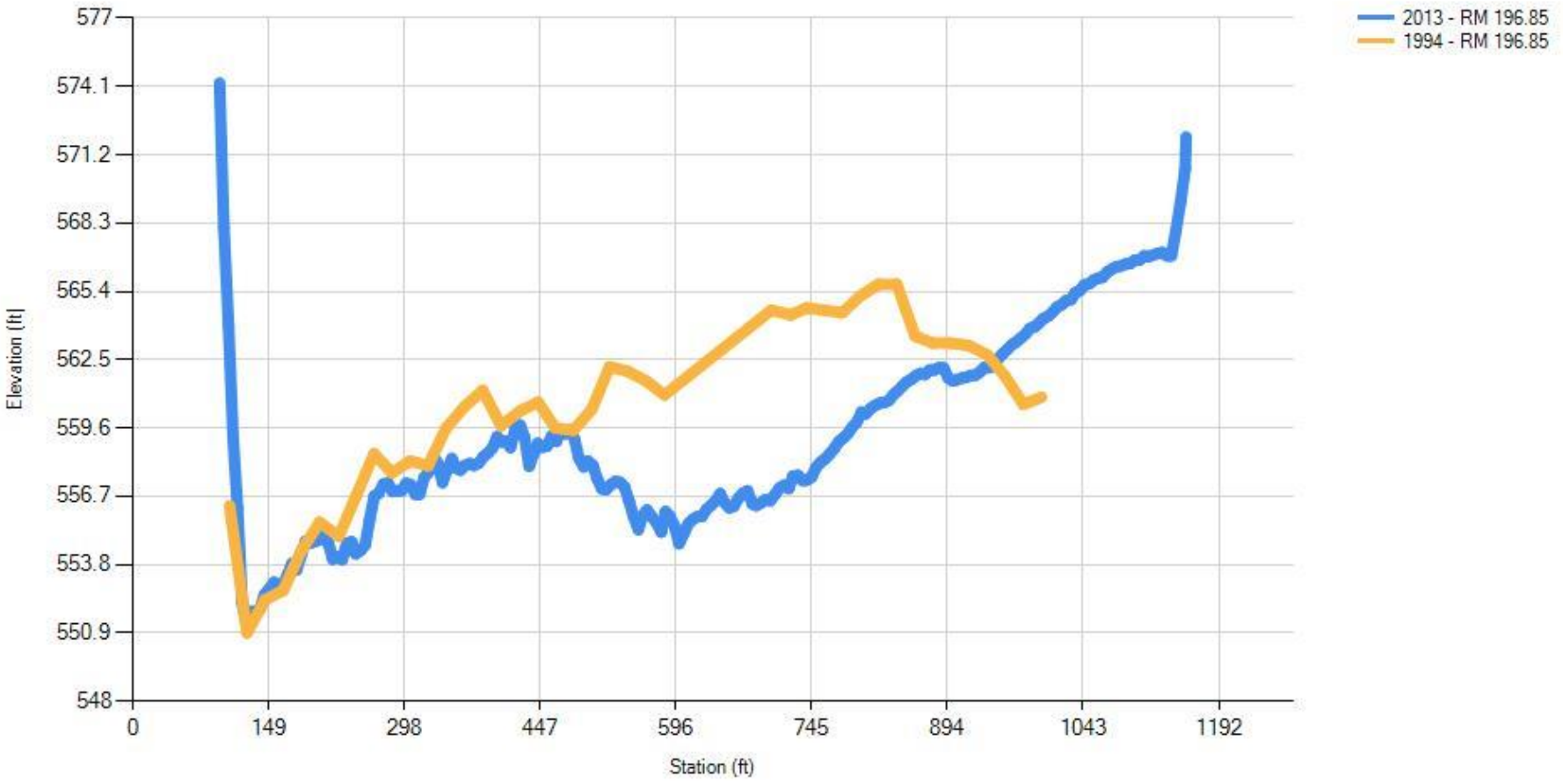


What happened from the 1994 to 2013?

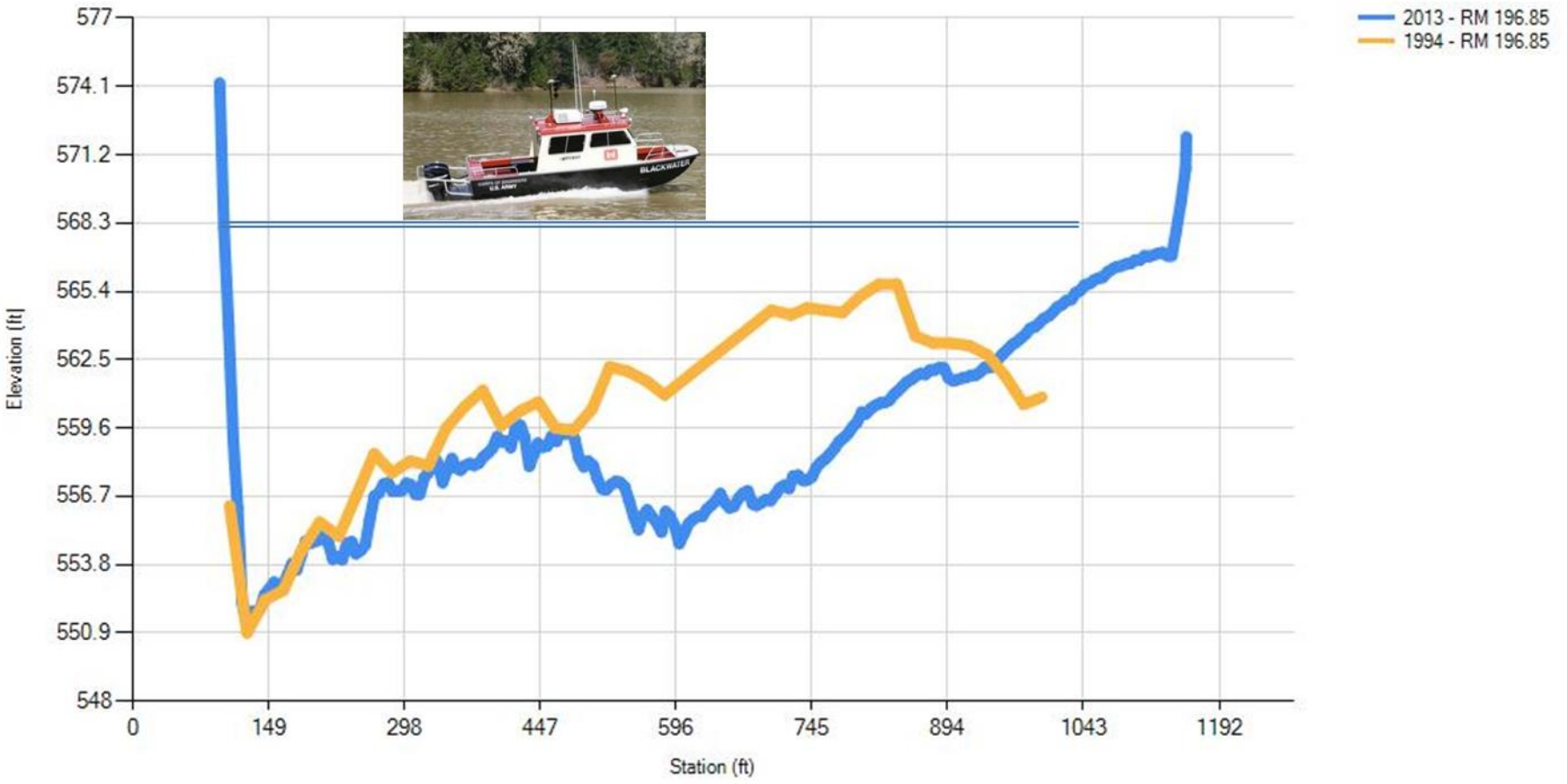
Consistency



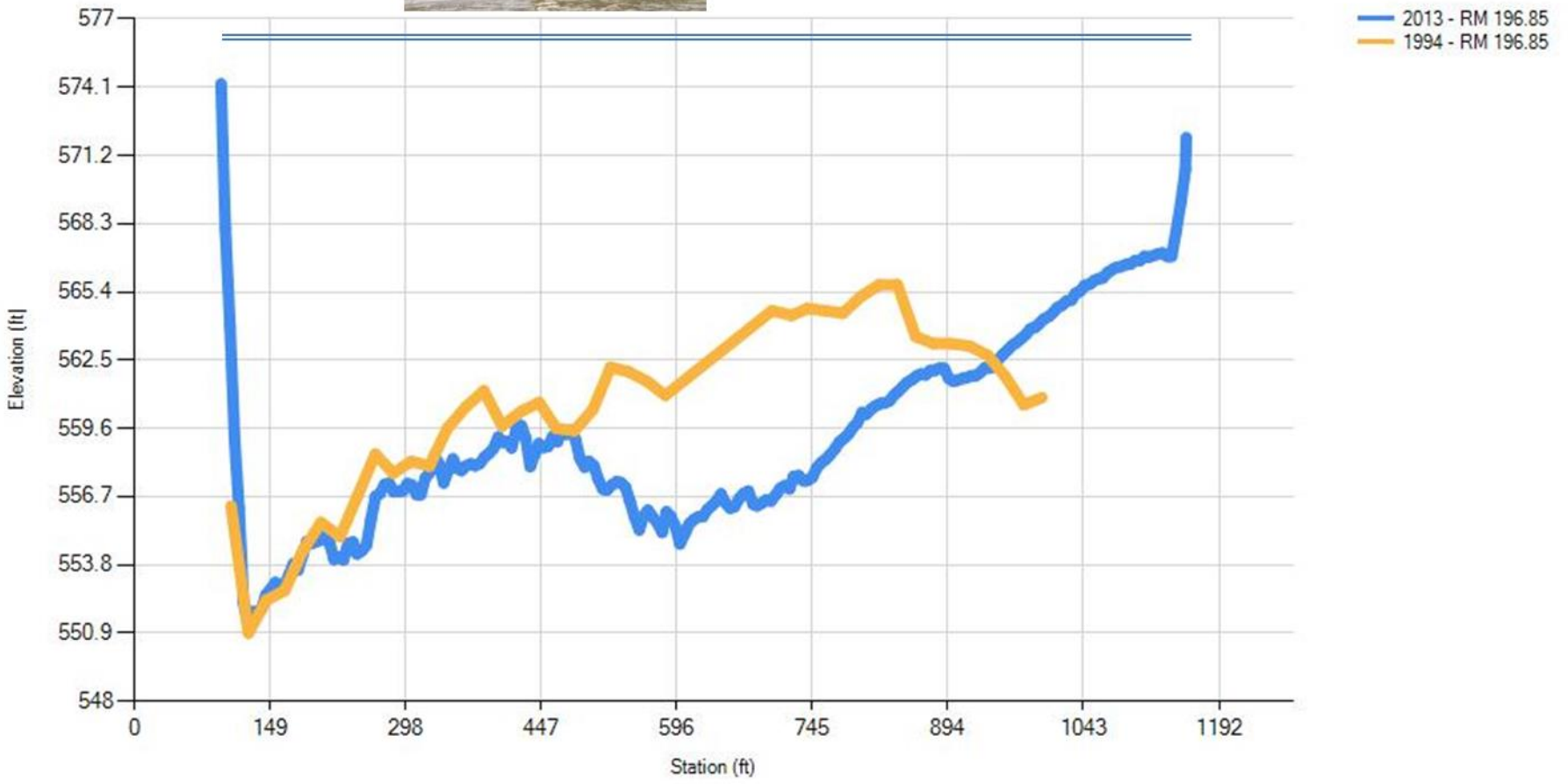
Consistency



Why would the extent differ from year to year?

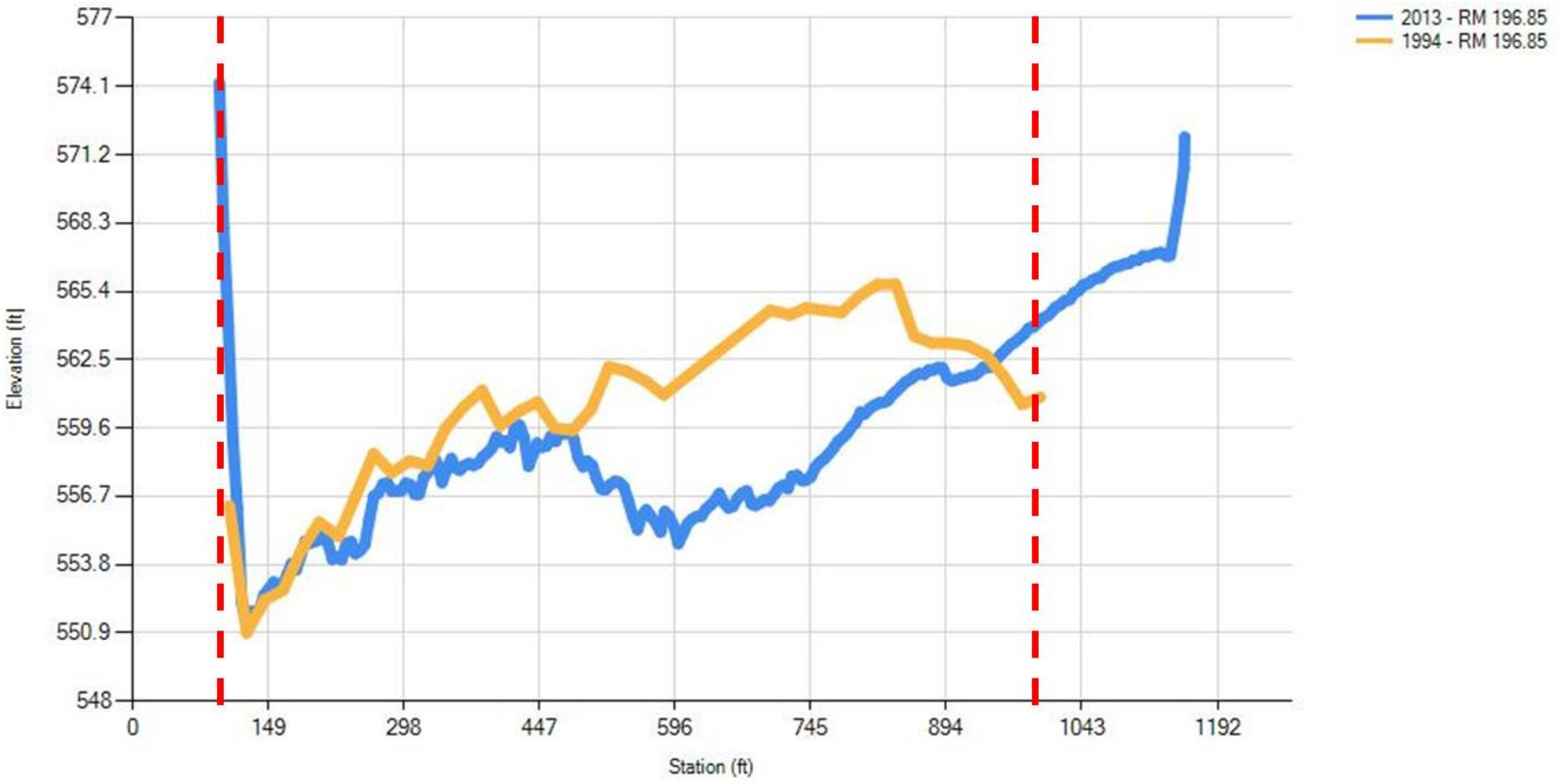


Why would the extent differ from year to year?



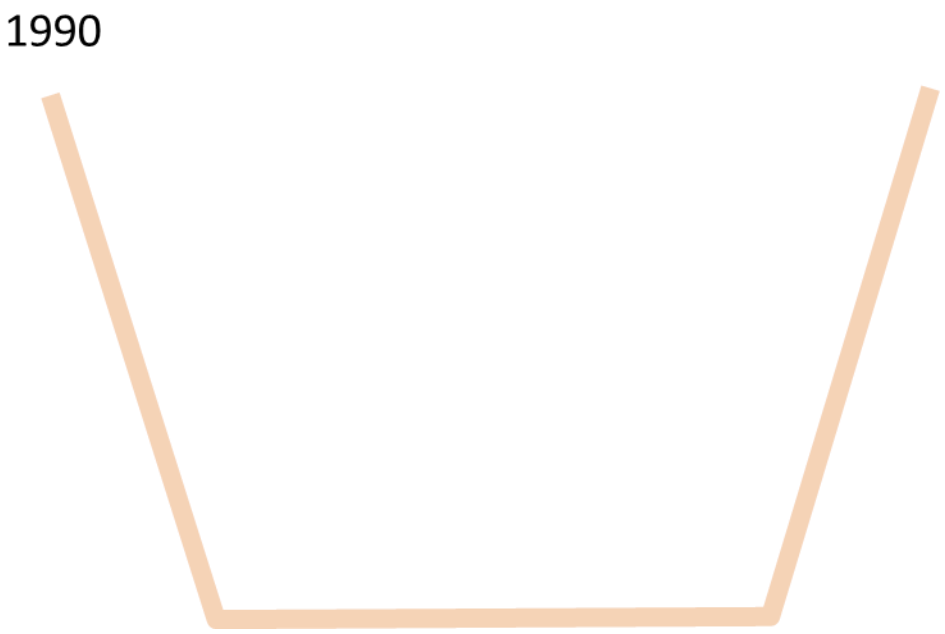
Why would the extent differ from year to year?

Consistency: Common Stations

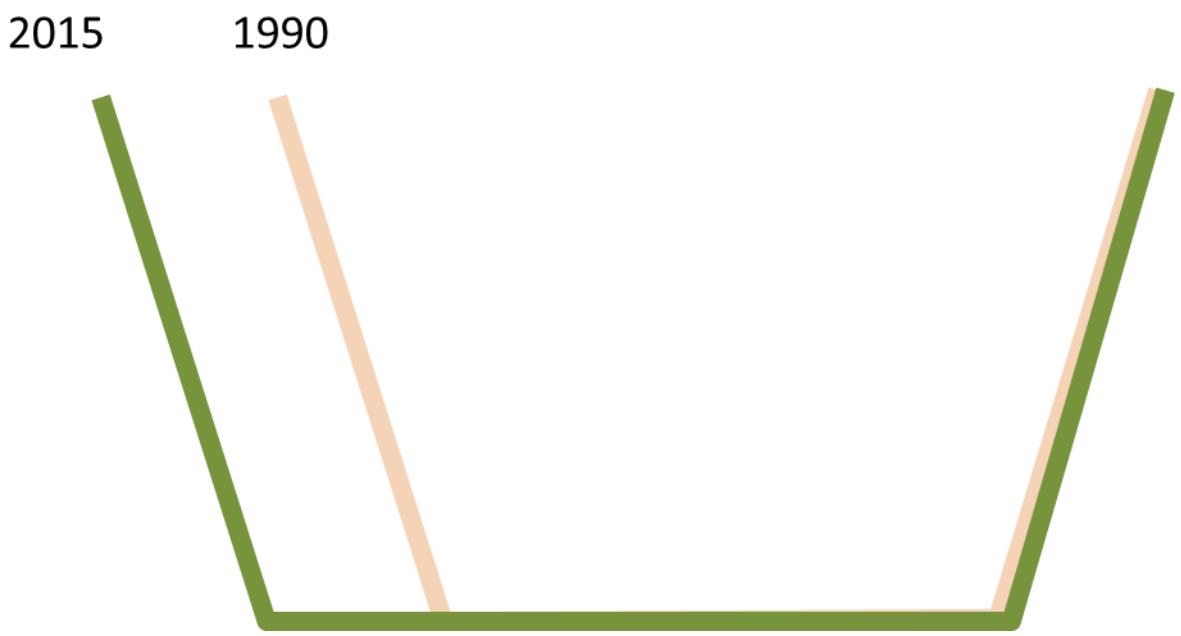


Truncate the surveys to a common extent

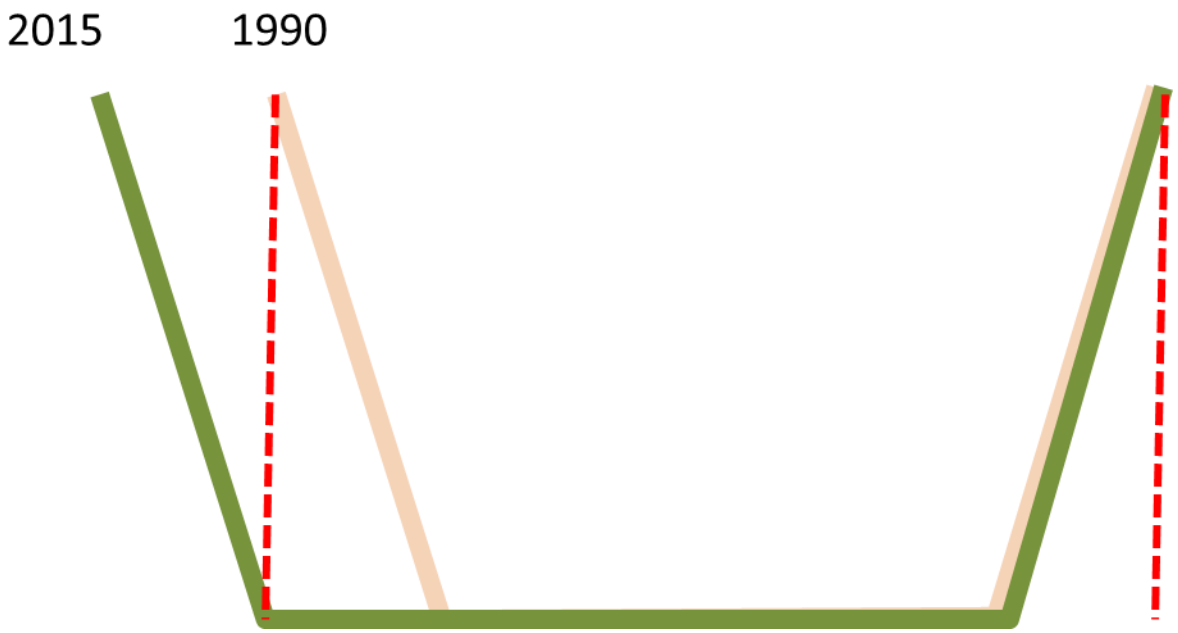
Common Stations: Epic Fail



Common Stations: Epic Fail

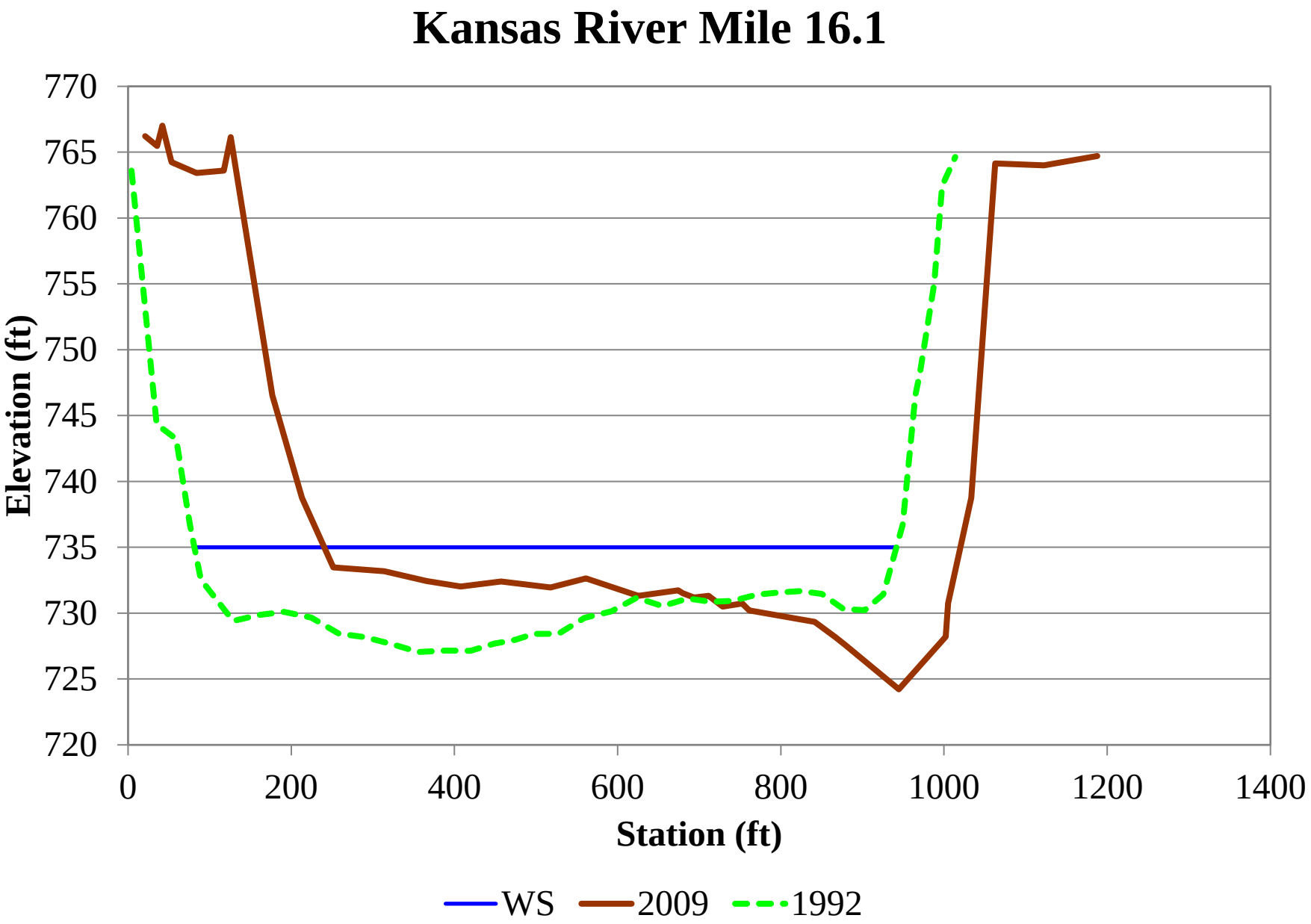


Common Stations: Epic Fail

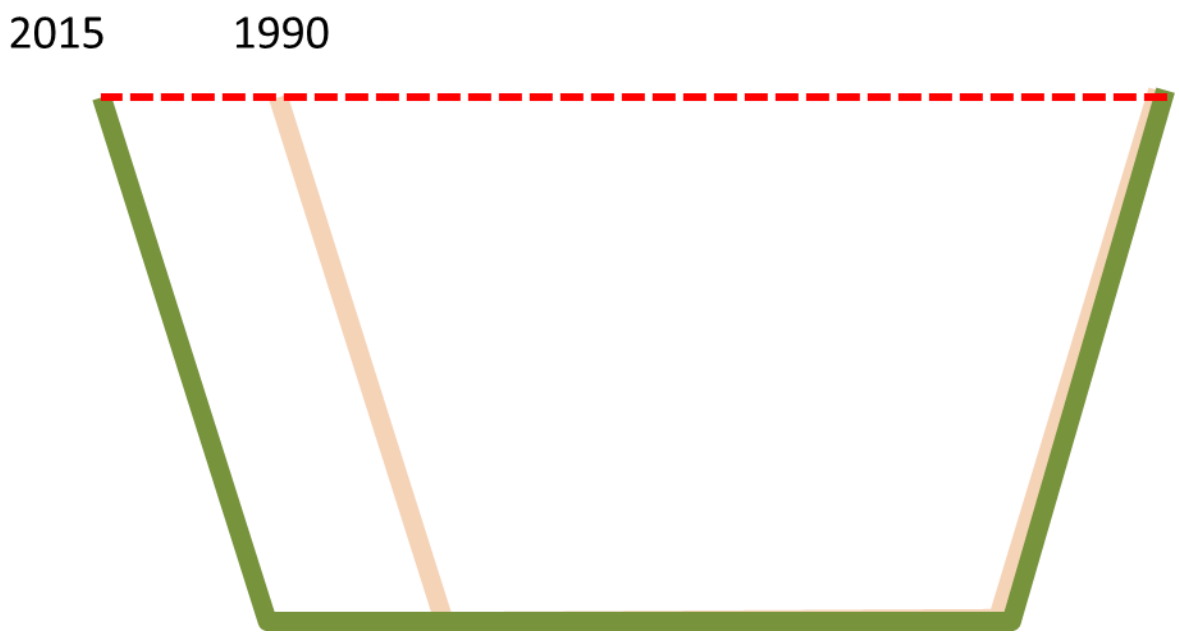


1990 includes the left bank, but 2015 does not.

The average bed computation will look like it dramatically lowered, when logically, it stayed about the same.


Kansas River Mile 16.1
Elevation (ft)
770
765
760
755
750
745
740
735
730
725
720
0
200
400
600
800
1000
1200
1400
Station (ft)
WS
2009
1992

Consistency: Common Elevation



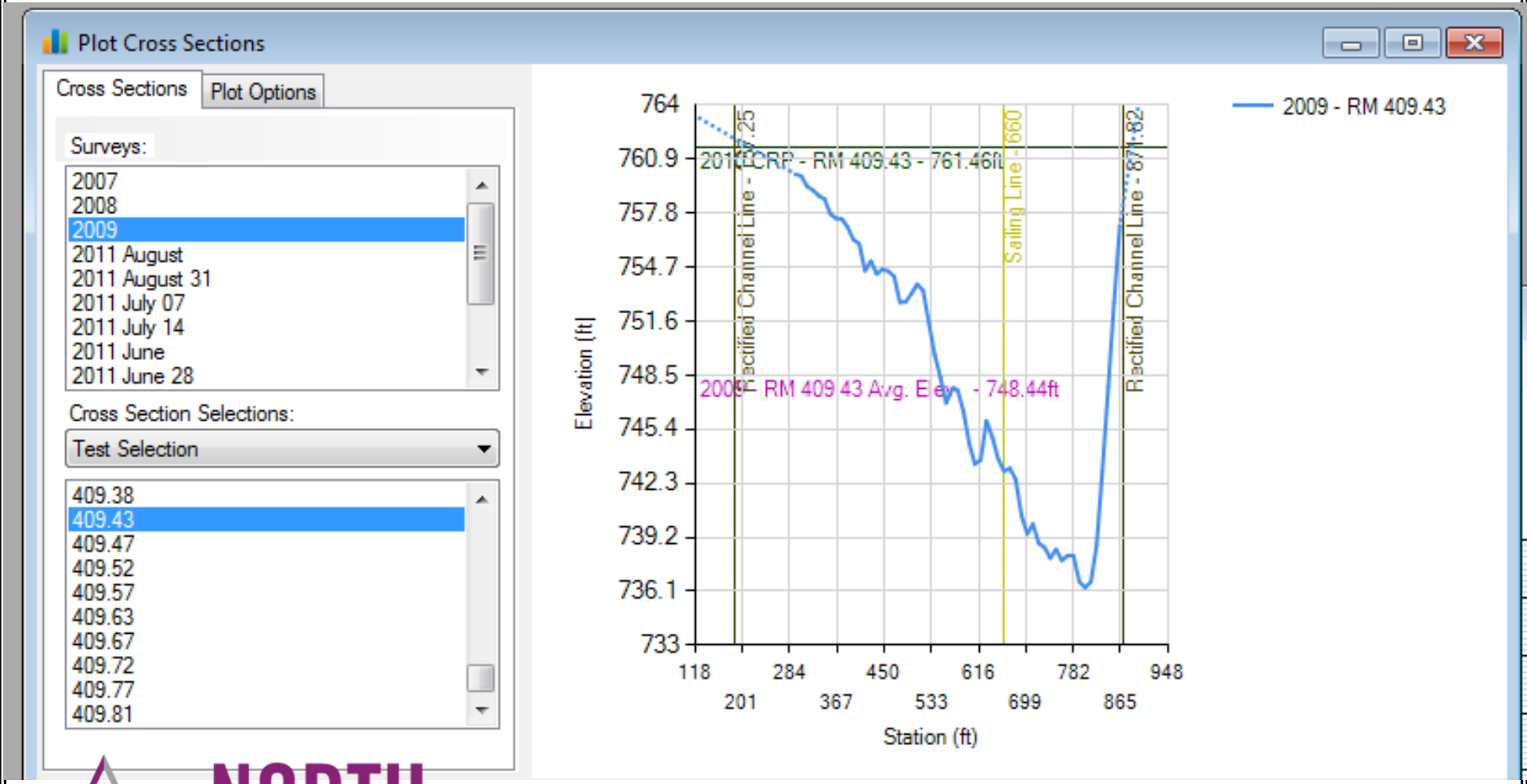
When doing this work “by hand”

- Find the data
- Format the data
- Find cross sections common to two surveys
- Truncate data to common lateral extent or common upper elevation
- Interpolate end points as needed
- Compute the cross sectional area change
  - Divide by width for average bed change
  - Multiply by length for volume change

Outline

- Cross sections
- Best Practices in XS Analysis
- **The XSViewer**
  - Plot XS
  - Compute volume change
  - Compute average bed elevation change
  - Compute depth distribution
  - Long profile plotter
  - Selection sets for QA/QC

XS Viewer



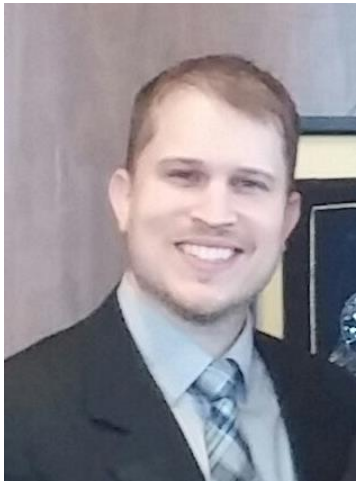
NORTH ARROW RESEARCH

http://xsviewer.northarrowresearch.com/

XS Viewer: Development Team

US Army Corps of Engineers
BUILDING STRONG®

John Shelley has a PhD in Civil Engineering (water resources) from the University of Kansas and BS in Civil Engineering from Brigham Young University.



NORTH ARROW RESEARCH

Philip Bailey, president of North Arrow Research, has a PhD in GIS and remote sensing from the Department of Geography at the University of Southampton, UK, and a Joint bachelors in Geography and Topographic Science from the Swansea University, Wales.

XSViewer Demos

Plotting Cross Sections

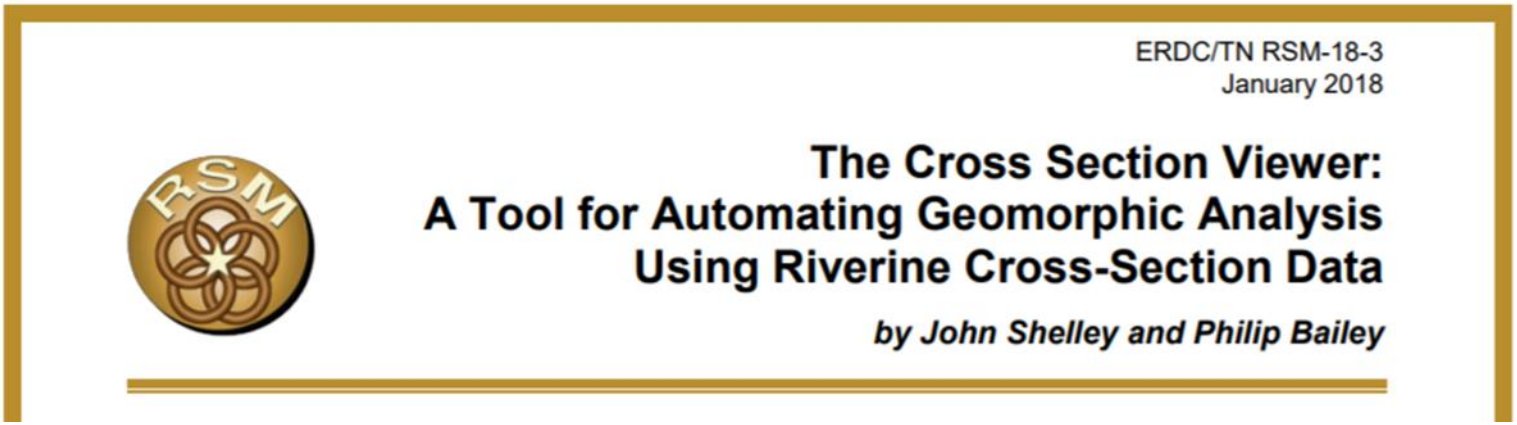
Longitudinal Cumulative Volume Change

So many more topics…

- What XS spacing do I need?
- Comparing geomorphic ratios
- Computing depth distributions
- Reach averaging
- Building surfaces from cross sections
- Uncertainty
- What else can go wrong
- Etc.

For more information

http://xsviewer.northarrowresearch.com/



John.shelley@usace.army.mil

Coming in 2021

- Online XSViewer tool

Some Image Credits

http://staff.concord.org/~btinker/GL/web/water/rivers_streams.html

http://www.fs.usda.gov/detail/hoosier/landmanagement/resourcemanagement/?cid=fsbdev3_017605

http://www.adirondackalmanack.com/2014/09/ausable-river association-seeks-restoration-equipment.html

http://www.oicinc.com/single_beam.html