Measuring Geomorphological Changes from Recent Flood Events in North Fish Creek, Wisconsin

Mary Griggs Burke Center for Freshwater Innovation | NORTHLAND COLLEGE

Andy Kasun, Matt Hudson, David Ullman

Background

North Fish Creek has been dramatically influenced by large-scale land cover change and intensive agriculture in the late 19th and early 20th Century. These activities resulted in an increase in runoff into the stream system leading to increases in stream channel incision, erosion, flood volume and sedimentation. USGS research on the erosion and sedimentation in the 1990's and monitoring over time gives a better idea of how these change over time as well as how they are impacted by flood events. Several events of interest, such as the storm of July 11, 2016, could have large impacts.

Objectives

- Measure impact of flood events on geomorphology of the channel.
- Document changes in erosion and sedimentation processes in North Fish Creek between 1995 and 2017.
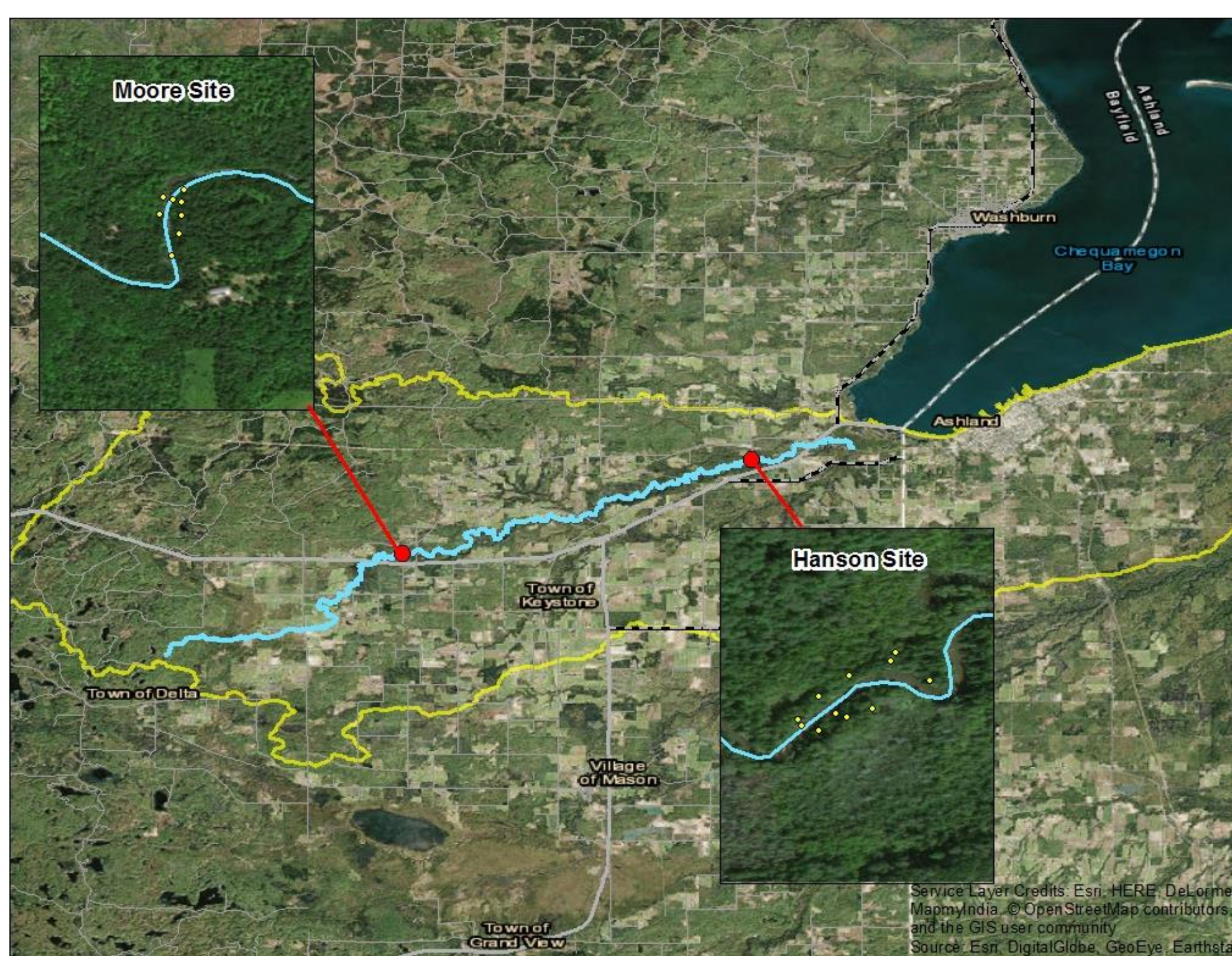

Figure 1. Map of watershed with insets of the Hanson and Moore study sites

Methods

- Two historic USGS sites were selected: one in the lower main stem within the floodplain (Hanson site), the other in the erosional upper reaches(Moore site) (Figure 1). These were selected in order to best represent the erosional and depositional reaches of the stream.
- Cross-sectional transects were re-created perpendicular to stream 100 ft apart. There were 4 transects taken at the Hanson site and 2 at the Moore site.
- Elevation measurements were taken with Top-Con-DL503 digital laser level in 1 ft. increments in channel and 2 ft on floodplain.
- Comparisons of channel transects were made with past data from 2015, 2007, and 1995 .
- Amount of erosion and deposition were calculated within channel and floodplain for both sites.
- Recurrence intervals calculated with combination of USGS and Burke Center peak discharge data.

Figure 2. Andy surveying stream transects

Results

- Aggradation rates were highest from 1995-2007 coinciding with two 16 year events (figure 4)
- There was little change in sedimentation from 2007-2015 to 2015-2017 periods
- Recurrence interval for the July 11, 2016 event was a value of 9.08 years.
- Results from Moore were inconclusive due to limited data.
- Cross-sectional area of floodplain channel has a decreasing trend over study period, especially post-2007 (Figure 3 and 5).
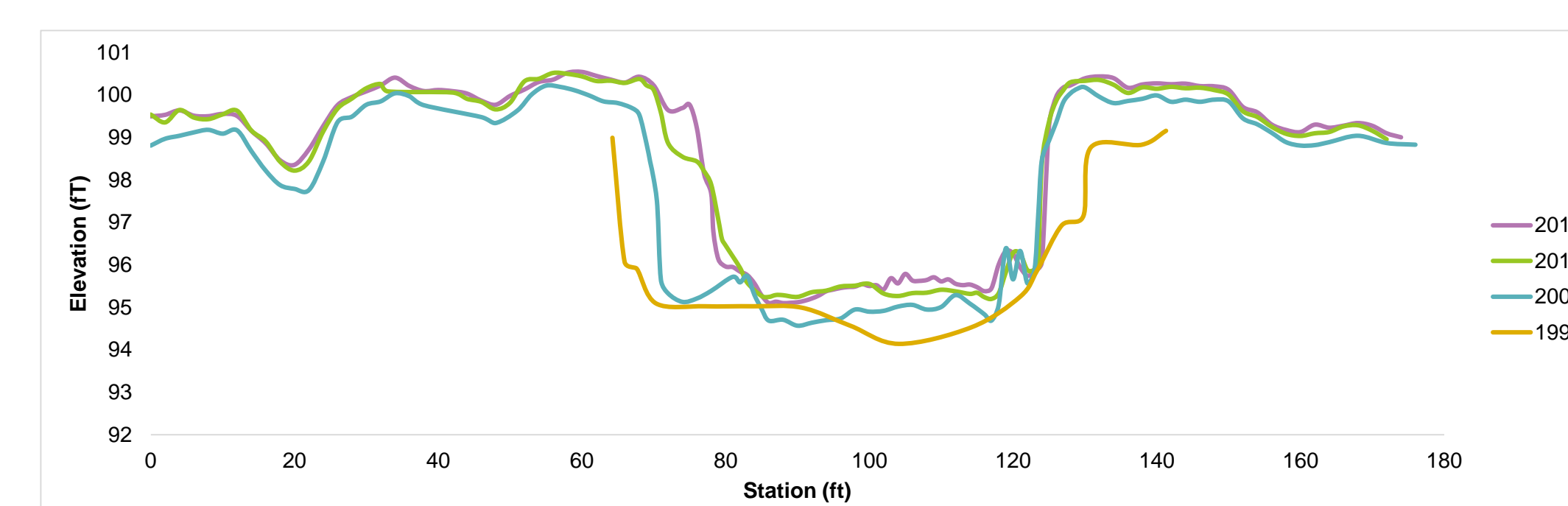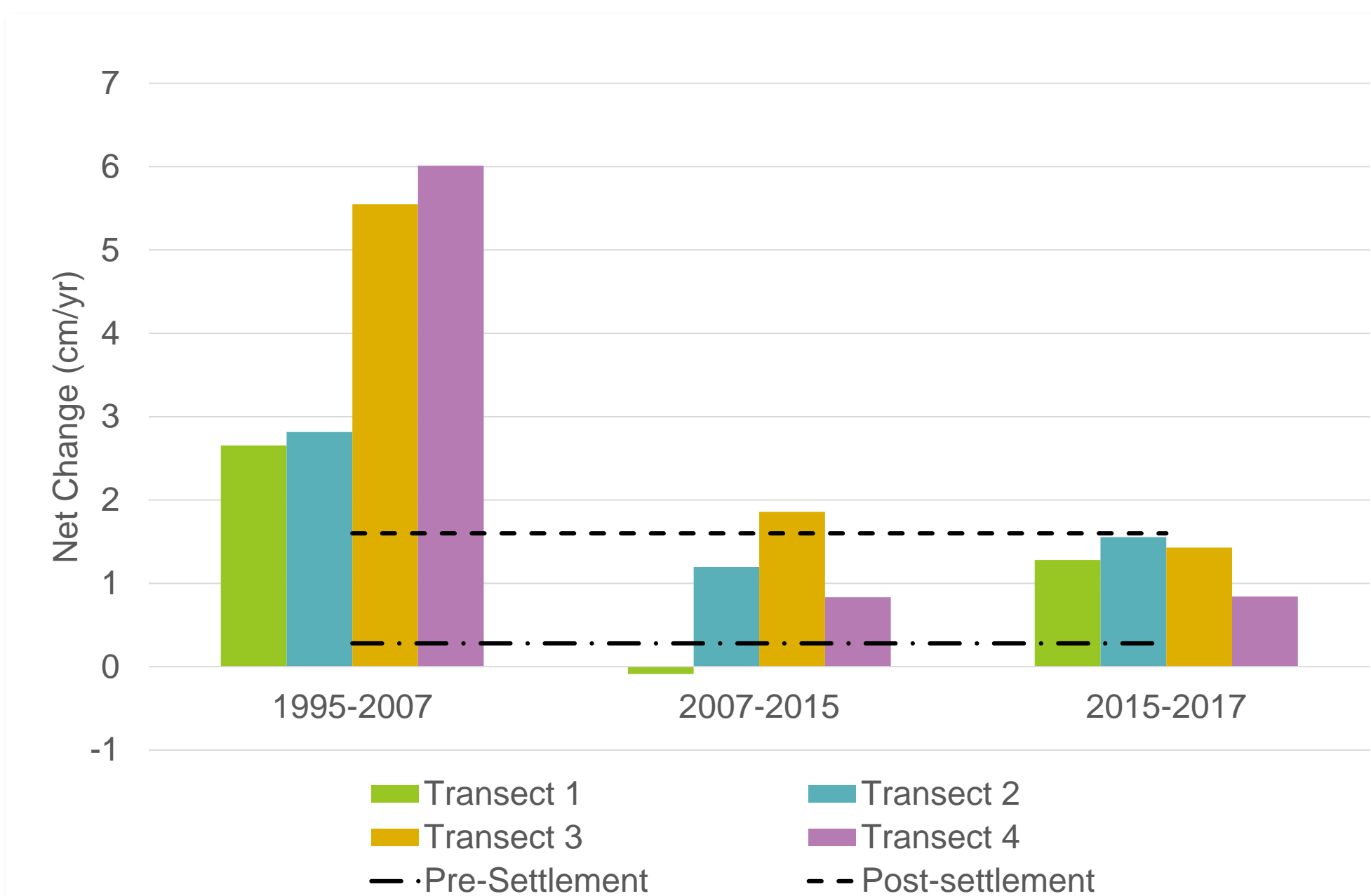

Figure 4. Aggradation rates (cm/year) compared from four separate surveying times compared to results from Fitzpatrick, 1999
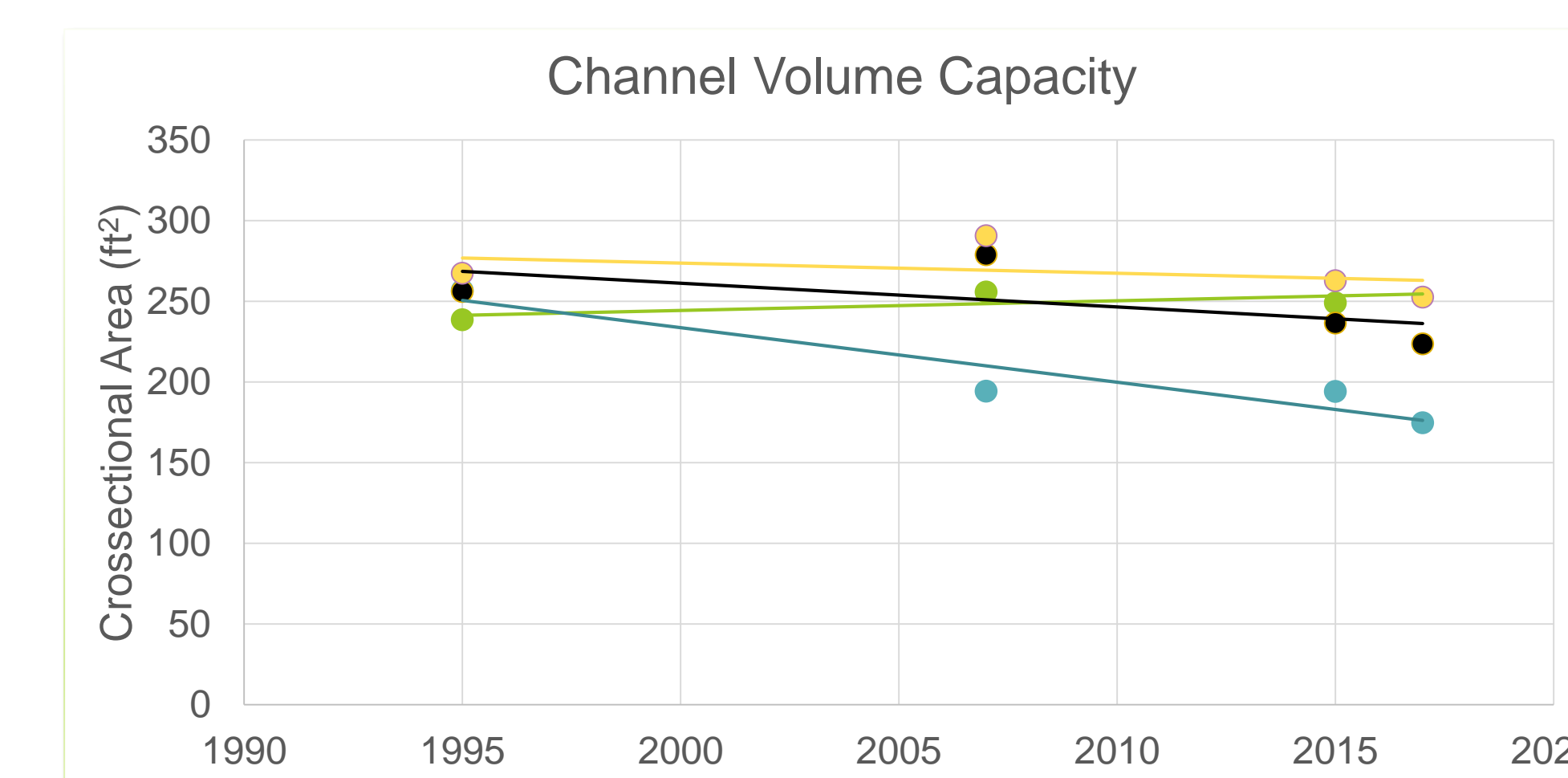

Figure 3. Cross-sectional survey of channel showing infilling of channel at Hanson site transect 1 in the depositional reach

Figure 5. Bankfull channel area in square feet for all four Hanson transects, 1995-2017

Conclusions

- A 9-year recurrence interval flood did not have a measurable amount of floodplain deposition.
- Greater sedimentation rates measured between 1995-2007 are likely due to larger recurrence interval floods (like those in 2005)
- Current floodplain sedimentation rates are similar to rates measured in the 1990s and are greater than pre-settlement rates.
- Reduction in channel capacity in floodplain reaches suggest more flooding and greater floodplain sediment deposition in the future.
- Additional transects at the Moore site to clarify erosional reach data
- Continued monitoring to determine if baseload of sediment does decrease

References

1. Fitzpatrick F.A., Knox J.C., Whitman H.E., 1999, Effects of historical land-cover on flooding and sedimentation, North Fish Creek, Wisconsin, USGS Water Resources Investigations Report, Pg. 1-12
2. Bro K.M., Fratt T.W, 2011, Fish creek watershed restoration and management plan

Acknowledgements