MARYSVILLE DAM FAILURE SEDIMENT CONTRIBUTIONS

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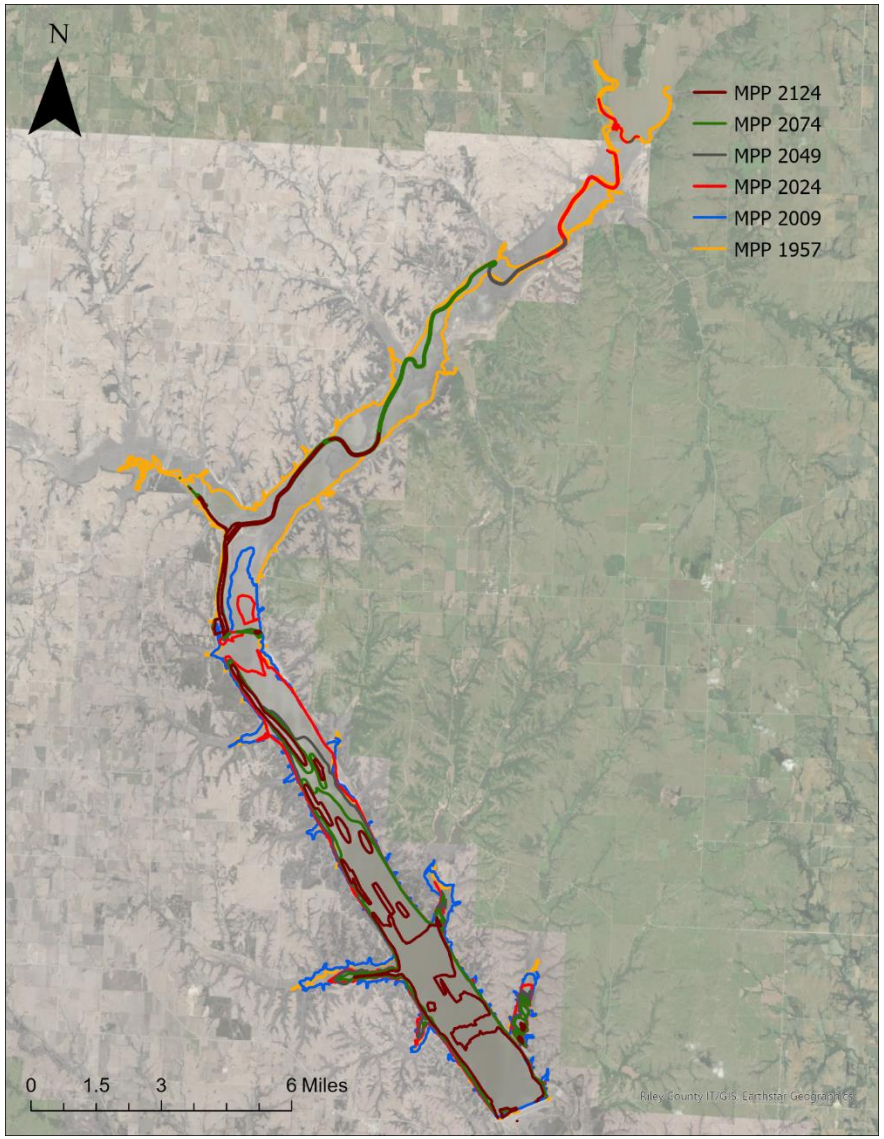
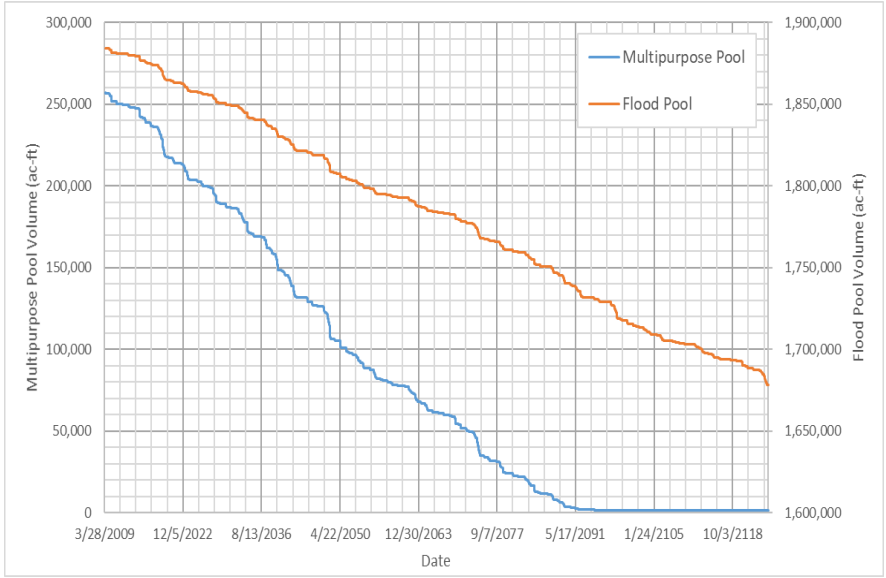
OUTLINE

- Tuttle Creek Lake
- Bank Stabilization
- Dam Failure
- Past Sediment Contributions
- Future Sediment Projections

TUTTLE CREEK LAKE SEDIMENTATION





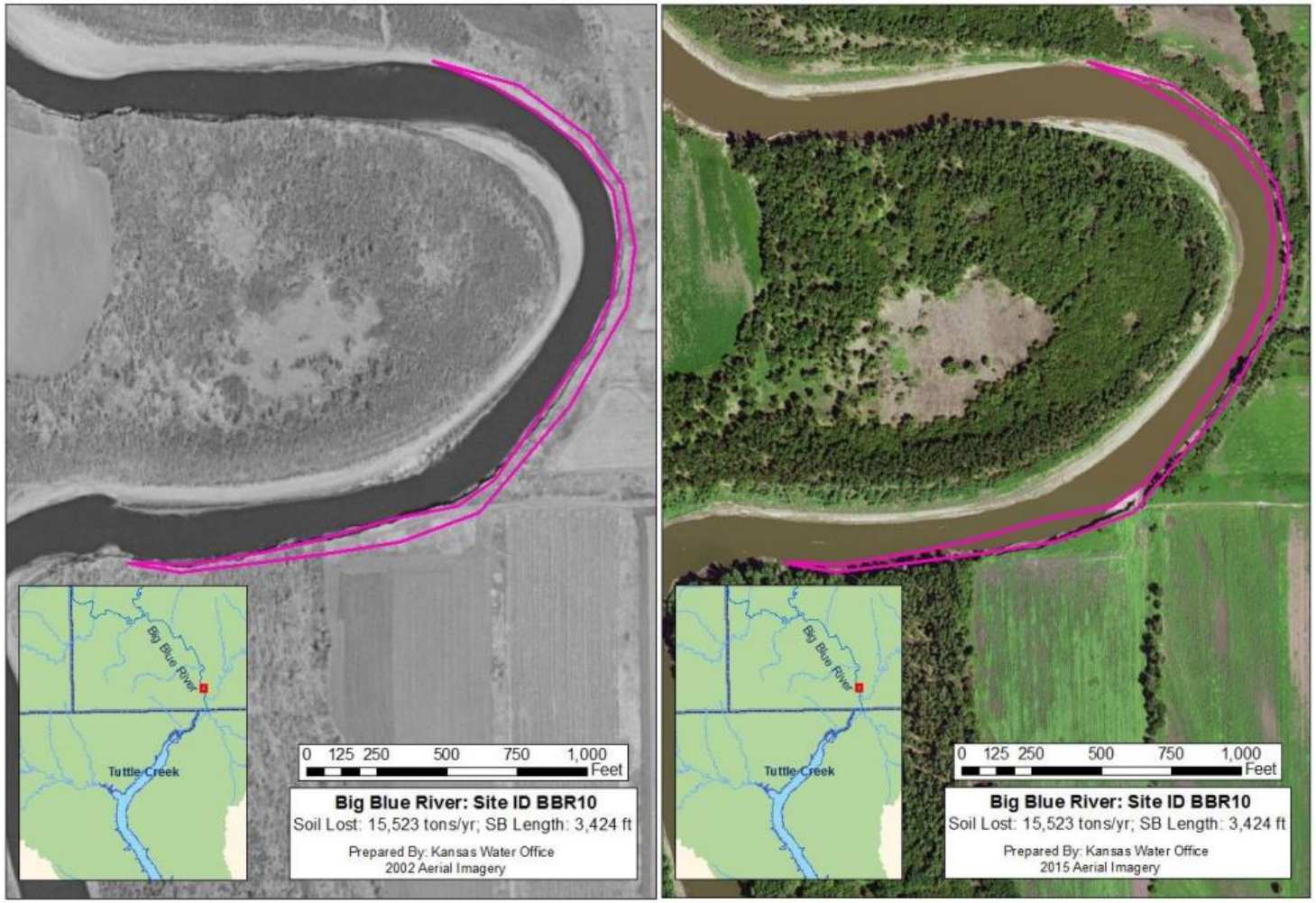
Year	2009	2024	2049	2074	2124
Cumulative Deposition Multi-Purpose Pool (ac-ft)	167,298	207,742	271,266	317,813	395,065
Average Annual MPP Deposition Since 2024 (ac-ft/yr)	3,351	2,773	2,541	1,862	1,545
Average Annual MPP Deposition over Increment (ac-ft/yr)	-	-	2,541	2,201	1,873
Cumulative Deposition Flood Control Pool (ac-ft)	58,393	91,037	161,758	204,383	330,358
Average Annual FCP Deposition Since 2024 (ac-ft/yr)	1,170	2,238	2,829	1,705	2,520
Average Annual FCP Deposition over Increment (ac-ft/yr)	-	-	2,829	2,267	2,393

WHERE DOES ALL THE SEDIMENT COME FROM?

Both channel-bank erosion and surface soil contribute significantly to sedimentation in reservoirs. In Perry Lake, channel-bank erosion was dominant. (Juracek and Zeigler, 2007)

BANK STABILIZATION

Figure 2: 2002 FSA & 2015 NAIP of a Streambank Erosion Site on the Big Blue River



(KWO, 2017)

BANK STABILIZATION

– Accounts for ~2.7% of volume accumulating in Tuttle Creek Lake

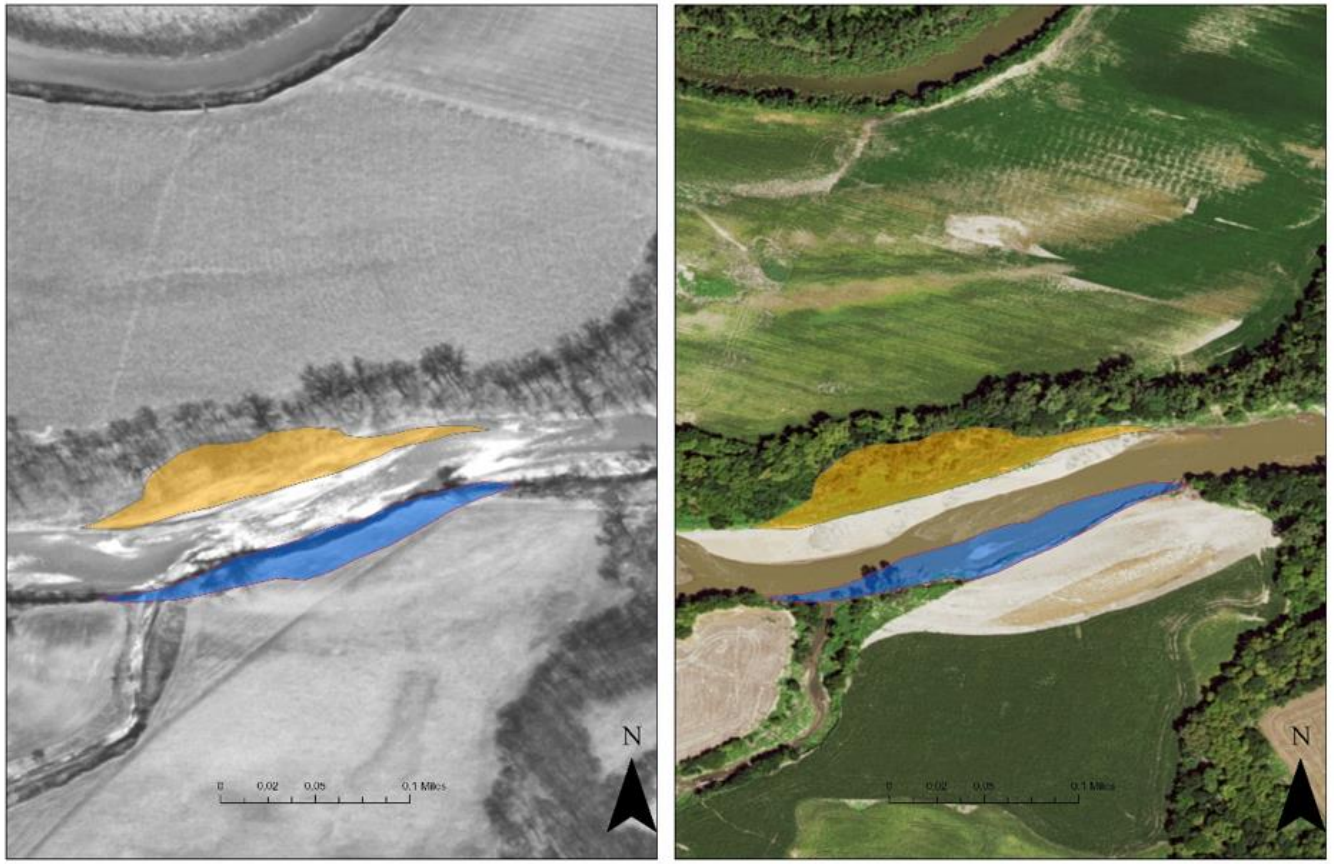
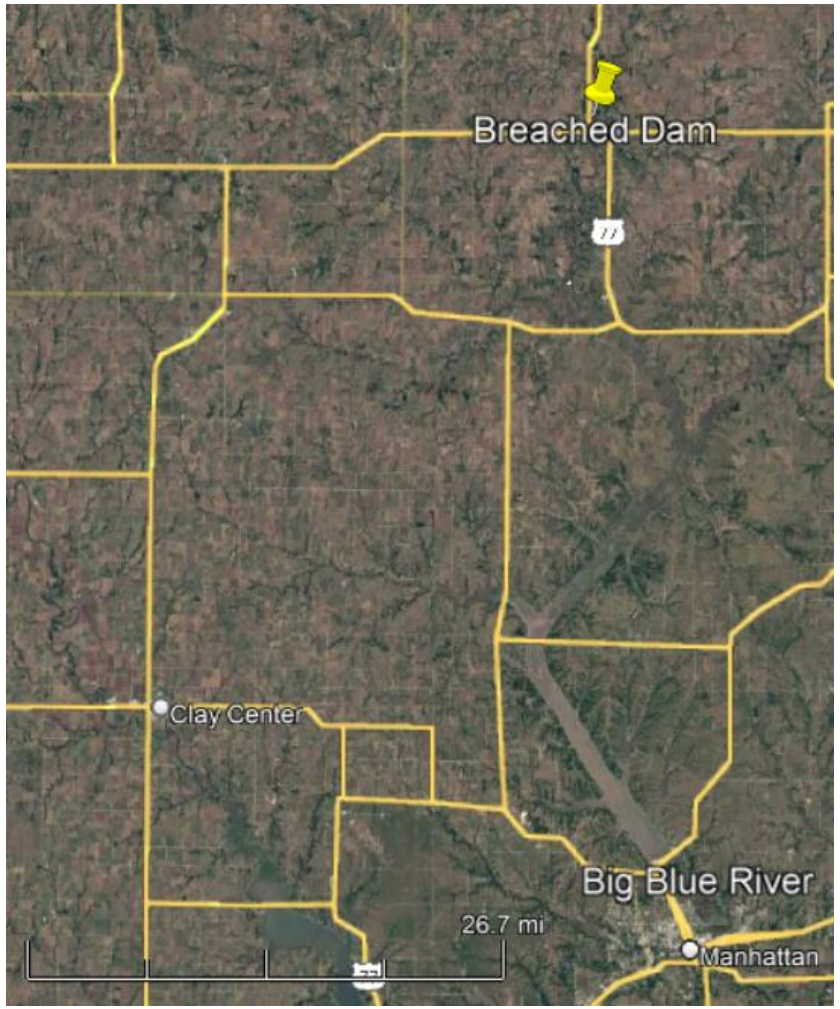


Figure 2: Deposition (orange) compared to Erosion (blue) between 2002 (left) and 2015 (right)

MARYSVILLE DAM FAILURE



Big Blue River as it appeared on October 3, 2014, with approximately 9,000 c.f.s. spilling over the dam. Erosion of the face of the dam is clearly evident on the far end. Streamflow over the dam on May 4, 2018, when it ultimately failed was approximately 4,000 c.f.s.

https://krwa.net/portals/krwa/lifeline/1807/MarysvilleHistoricLow.pdf

GRADE CONTROL

Headcuts refer to bed degradation that works its way upstream

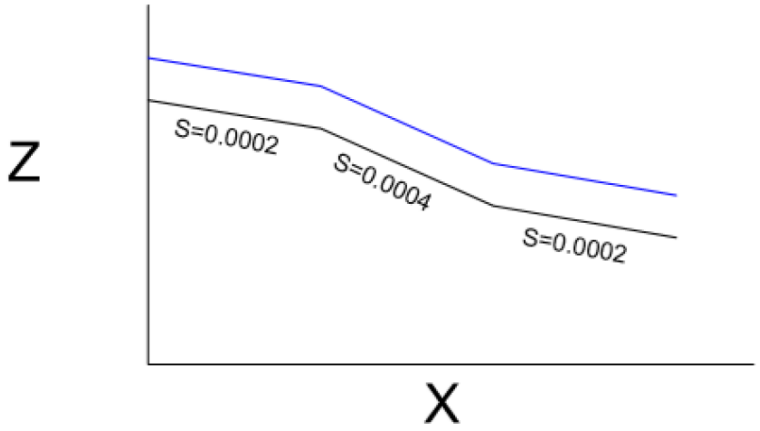
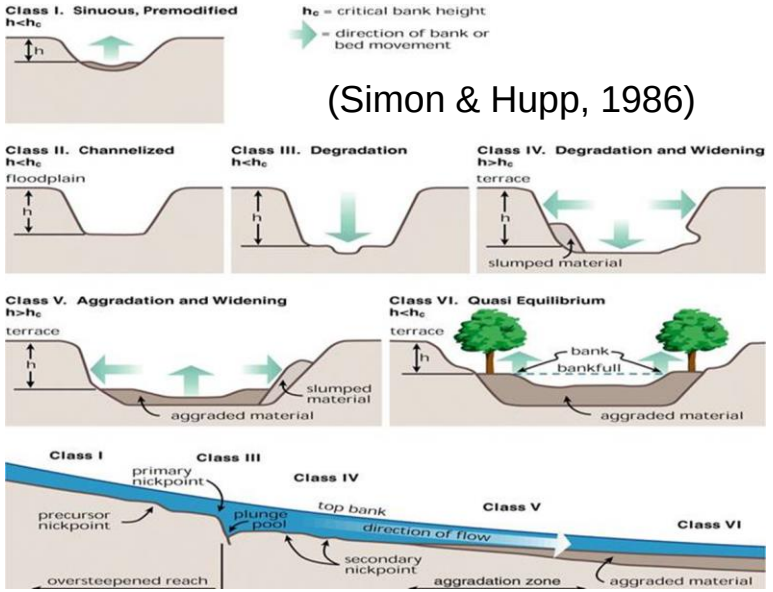


Figure 13: Scenario 1: Channelization

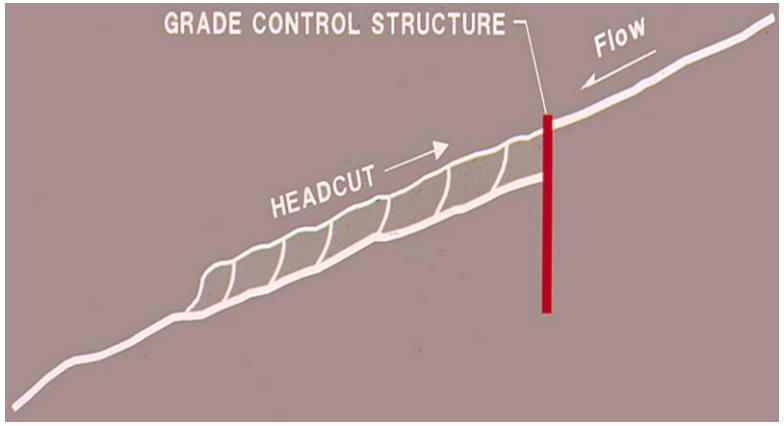
(Mansfield, 2020)

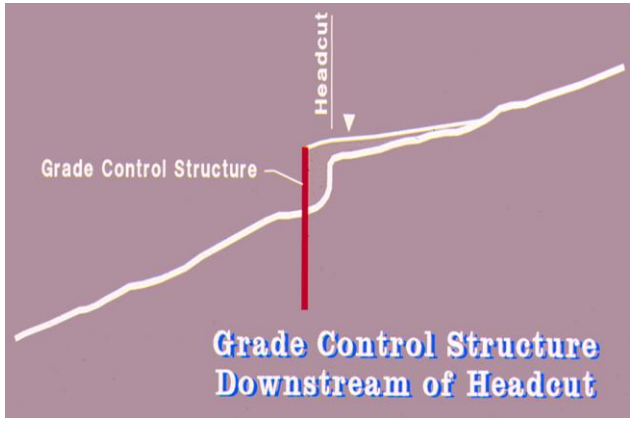
6-stage Channel Evolution Model



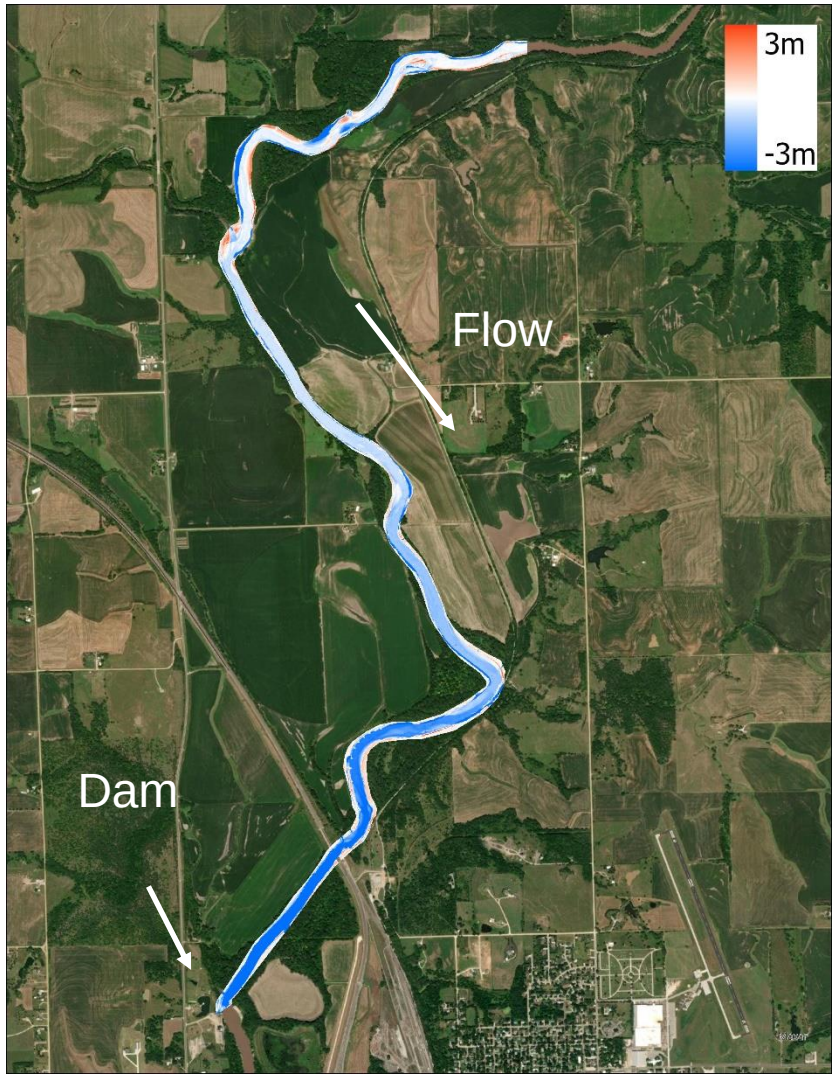
(Simon & Hupp, 1986)

Physical Processes: Channel Degradation & Grade Control Concepts



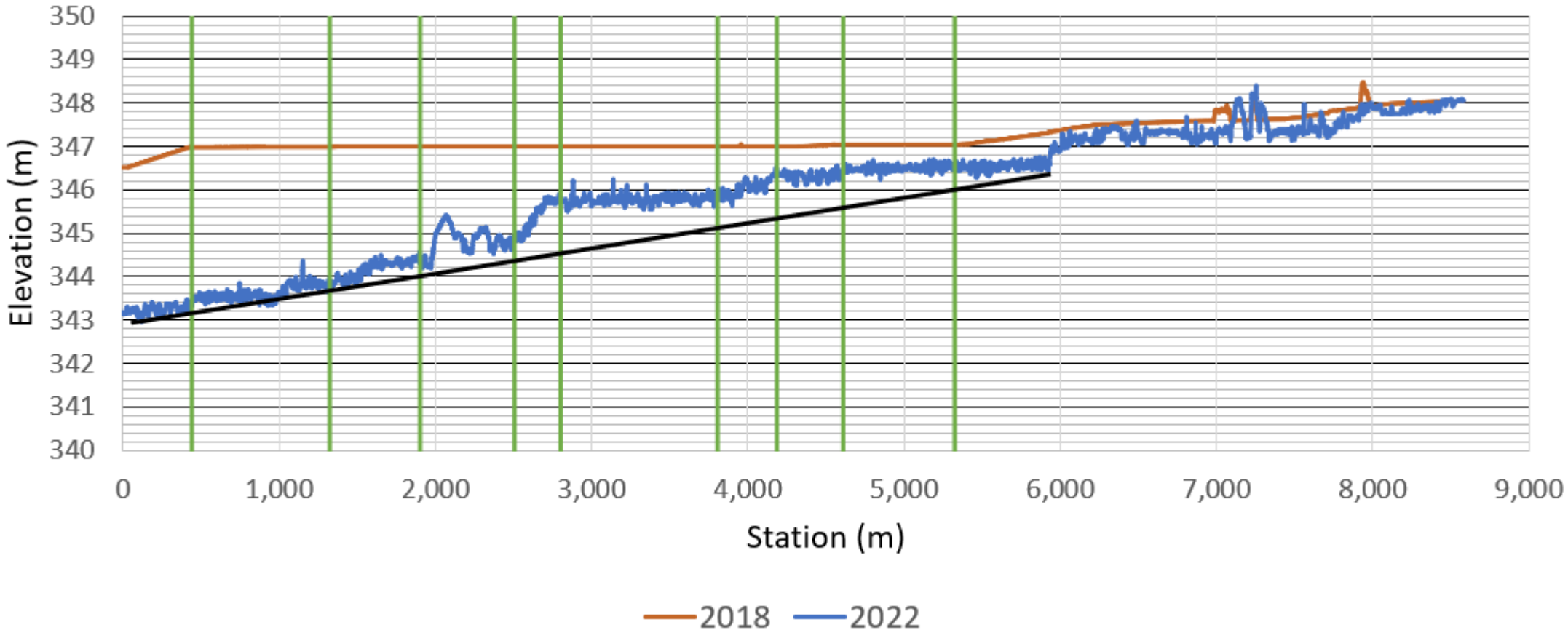


SEDIMENT CONTRIBUTIONS TO DATE



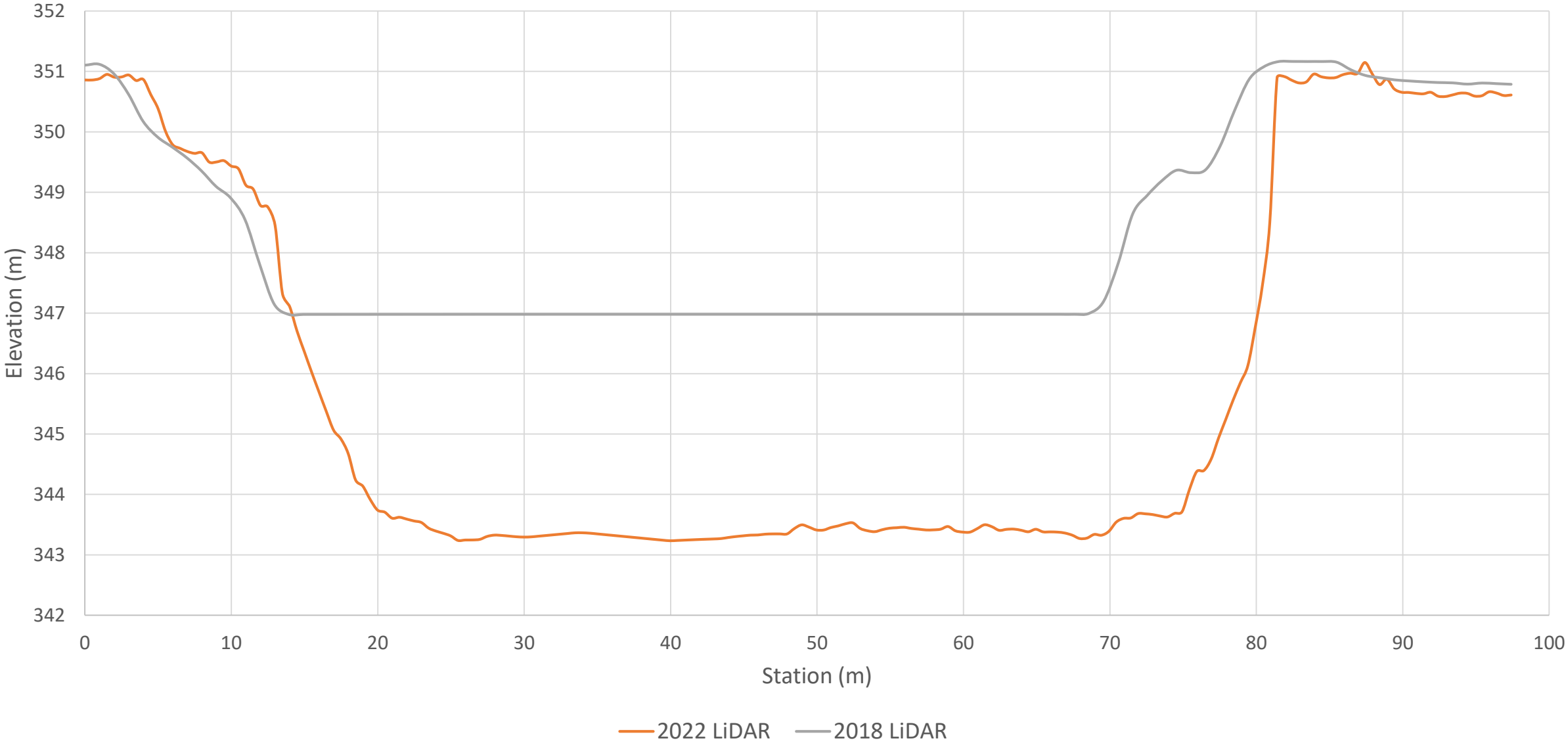
Total Deposition in MPP	Percentage of deposition
acre-ft/yr	%
104	2.9%

FUTURE SEDIMENT PROJECTIONS

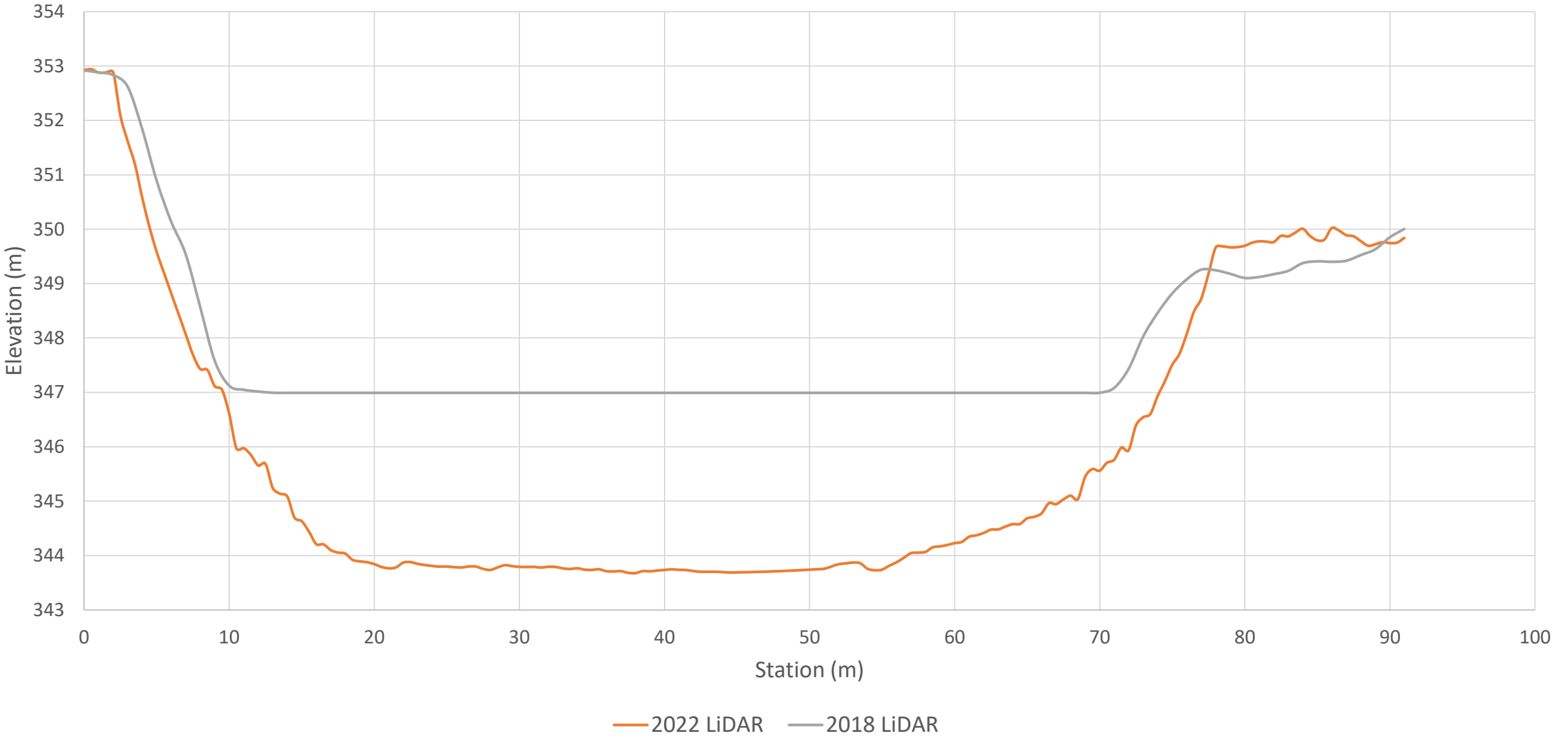


AERIAL PHOTOGRAPHY OF HEADCUT

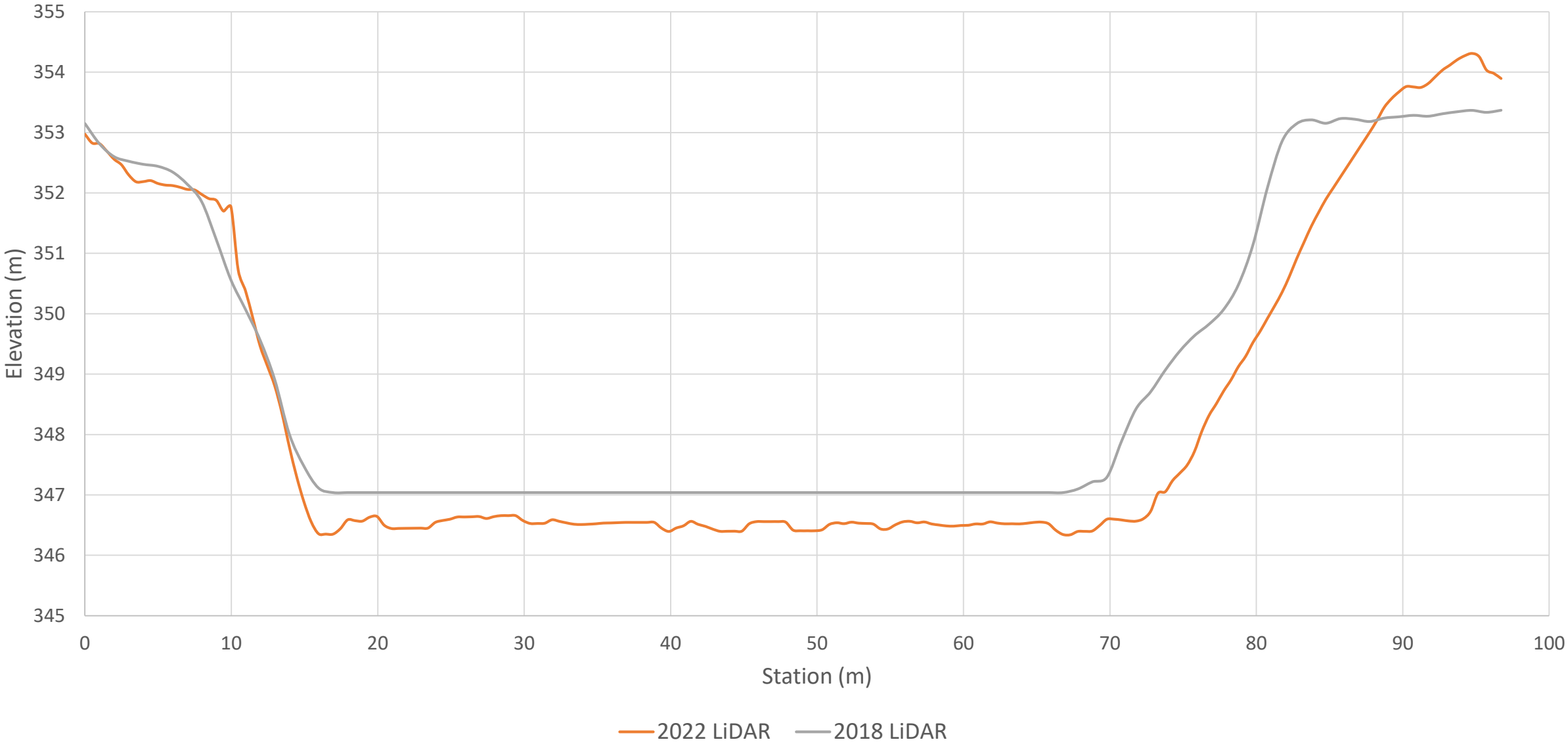
CROSS SECTION 1



CROSS SECTION 2



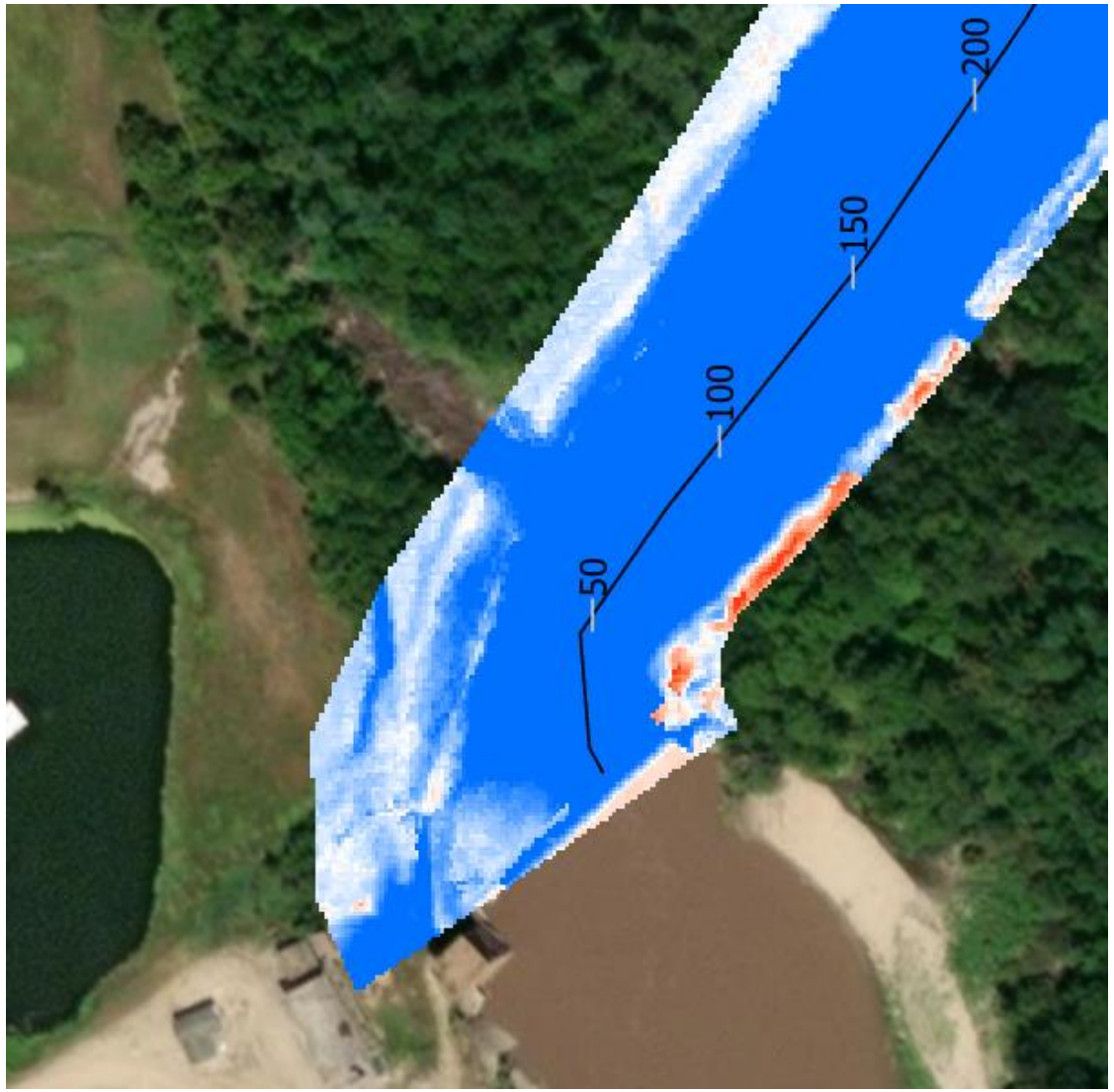
CROSS SECTION 9



TOTAL SEDIMENT PROJECTIONS

Downstream	Upstream	d1	d2	Length	Average Area difference (m^2)	Volume (m^3)	Volume (acre-ft)
2	3	344.4	344	578	10.7	6,171	5.0
3	4	345.0	344.4	604	27.2	16,445	13.3
4	5	345.8	344.5	295	55.5	16,402	13.3
5	6	345.8	345.2	1,005	58.4	58,695	47.6
6	7	346.5	345.4	380	38.9	14,775	12.0
7	8	346.5	345.6	424	51.6	21,890	17.7
8	9	346.5	346	714	58.3	41,617	33.7
9	Hard Point	346.4	346.4	596	26.1	15,556	12.6
					Total	191,549	155.3

TRIBUTARY HEADCUTS

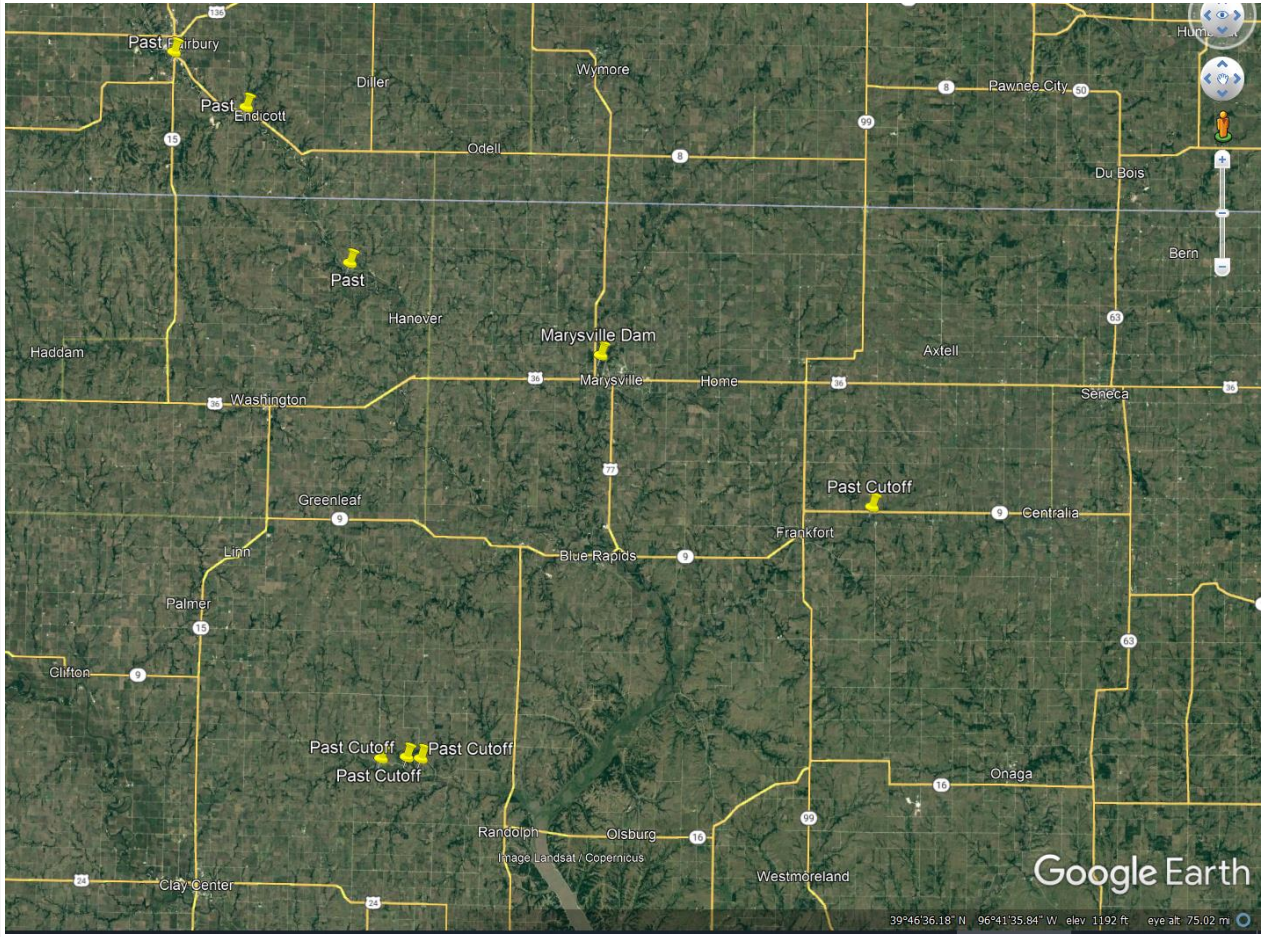


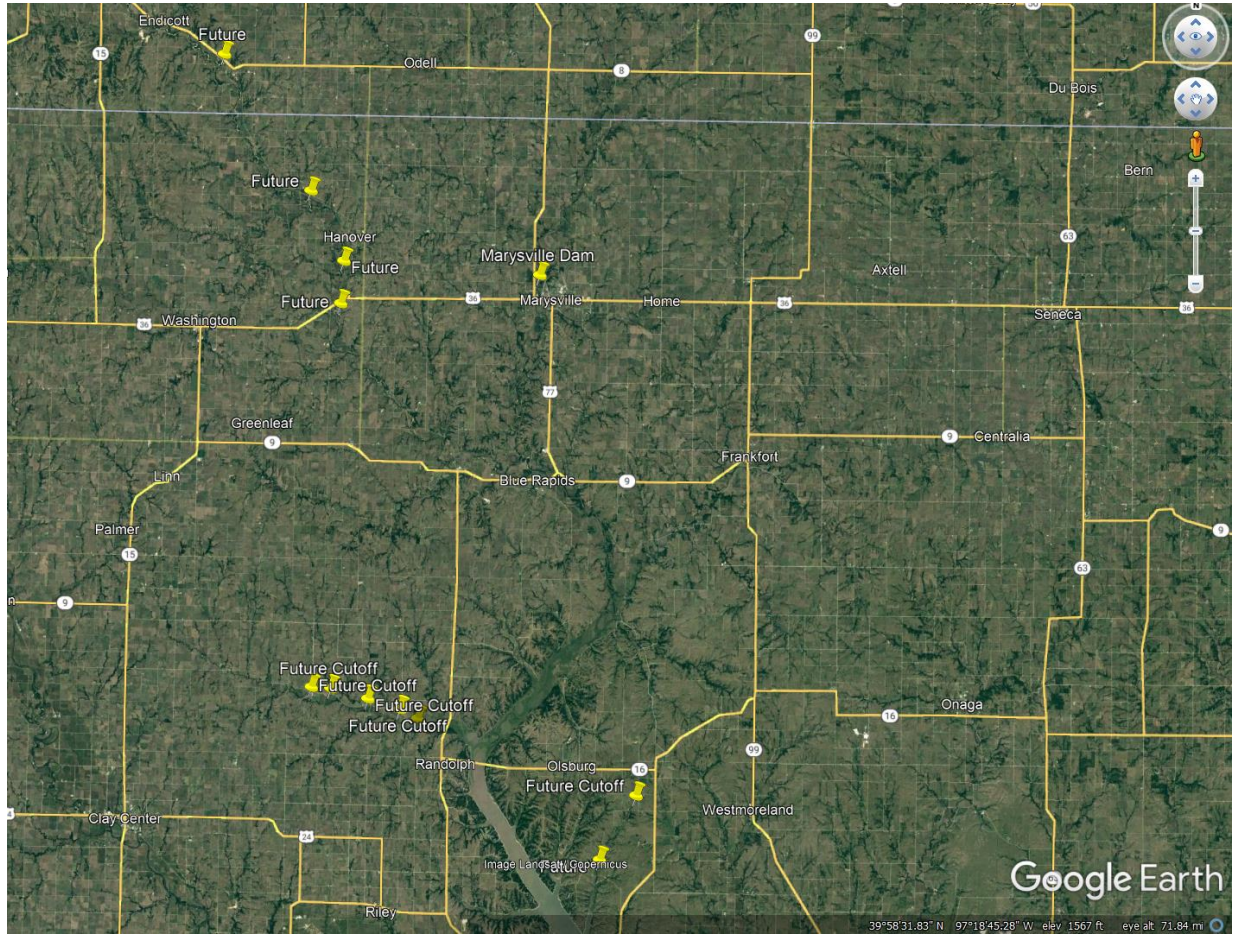
COST COMPARISON

	Dredging Now	Grade Control now
Cost per cubic yard	$6.70	$2.46
Total Cost	$1 Million	$370,000

	Dredging before dam failure	Grade Control before dam failure
Cost per cubic yard	$6.70	$0.45/CY
Total Cost	$5.5 Million	$370,000

PAST AND FUTURE CUTOFFS





CONCLUSIONS

- Total sediment load accounted for approximately 2.9% of the total MPP deposition in Tuttle Creek Lake between 2018-2022
- The headcut appears to be halfway to the hard point
  - Degradation may stabilize by 2026
- Stabilizing the headcut now would prevent approximately 0.7% of the annual load from reaching the Tuttle Creek Lake Multi-Purpose Pool

ACKNOWLEDGEMENTS

– Regional Sediment Management (RSM)
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QUESTIONS?

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- USACE. 2022. Kansas River Reservoirs Flood and Sediment Study. Appendix D2.3: Tuttle Creek Lake Future without Project Sedimentation (DRAFT)