



Geomorphology and Vegetation Report

Nicole Fijman & Libby Casavant

PRRIP TAC

July 2025

Table of Contents

- Mechanical Management
- Hydrologic Analysis
- Hydrodynamic Modeling
- Land Cover Classification
- Volume Change

Scope and Reporting Scales

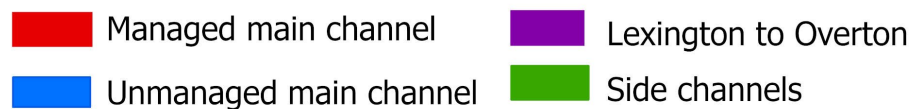
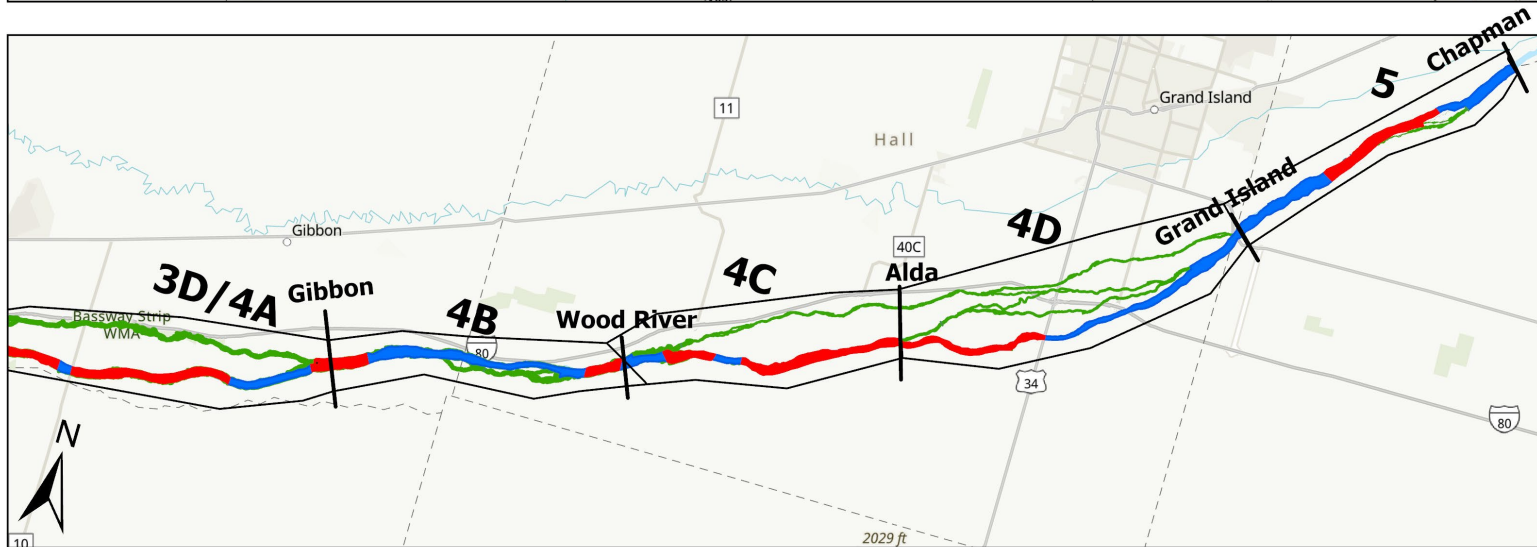
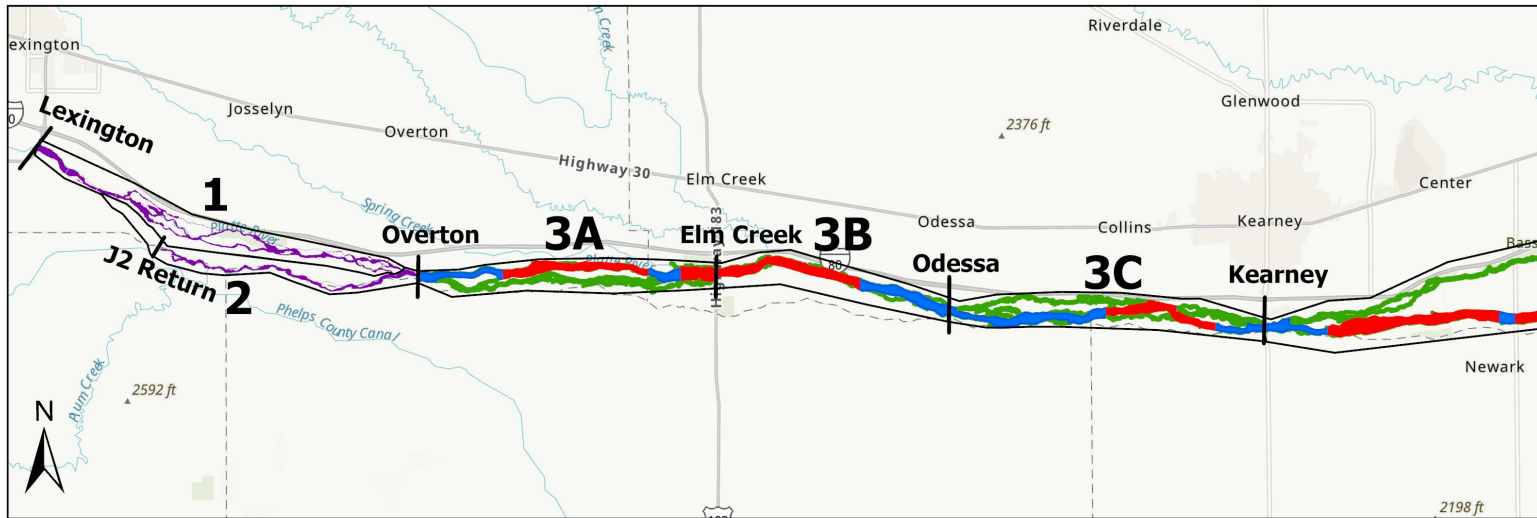


Table of Contents

- **Mechanical Management**
- Hydrologic Analysis
- Hydrodynamic Modeling
- Land Cover Classification
- Volume Change

Mechanical Management

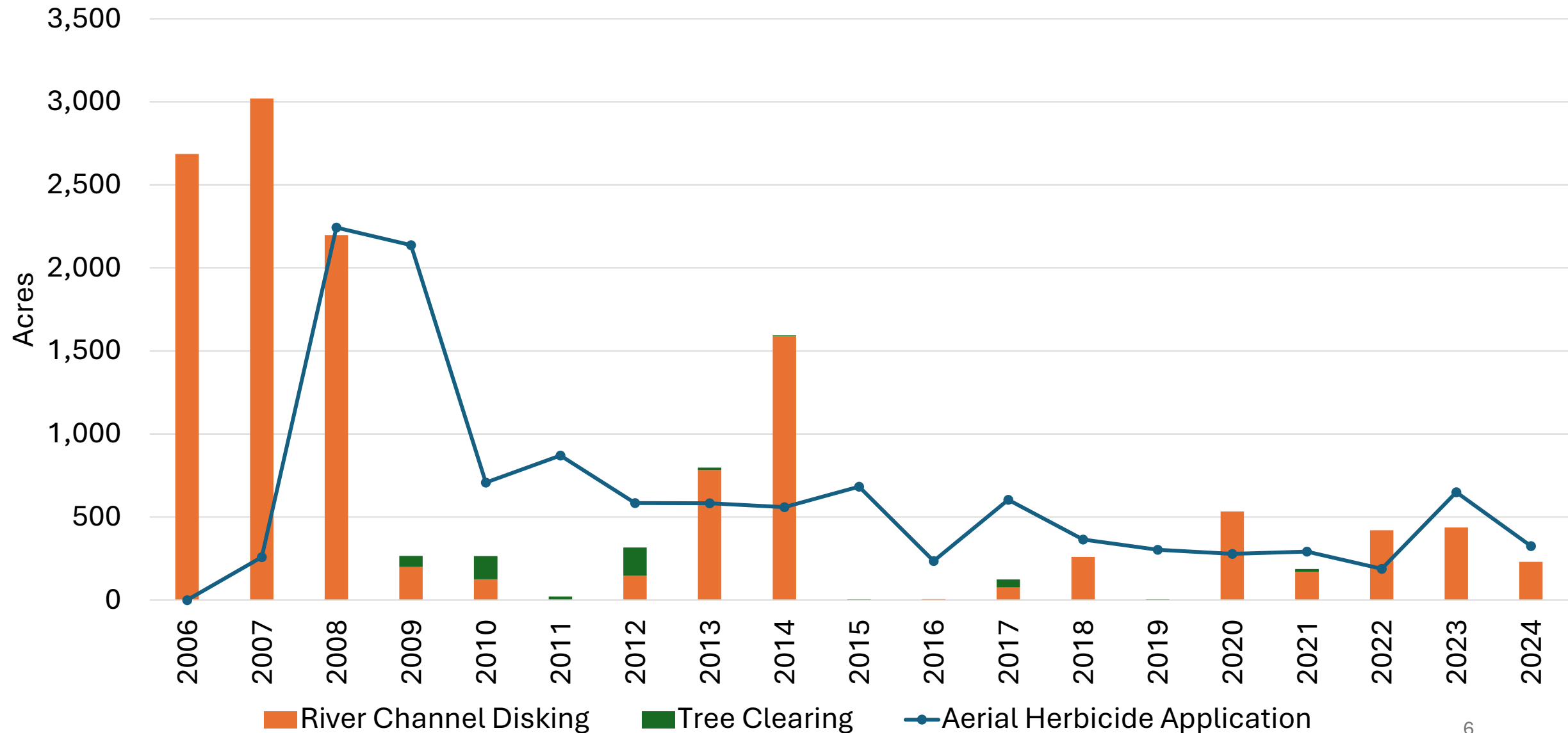
Purpose:

- Provide highly suitable WC roosting habitat
- Increase Unvegetated channel width

Actions:

- Aerial Herbicide Application
- Tree Clearing
- Disking
- Sediment Augmentation

Mechanical Management by Year



Sediment Augmentation by Year

Year	Augmented (CY)	Augmented (tons)	Location
2012-2013	125,000	182,000	Dyer Tract and Cottonwood Ranch
2017	23,000	34,500	J-2 Return (South Channel)
2018	42,900	64,305	J-2 Return (South Channel)
2019	42,300	63,500	J-2 Return (South Channel)
2020	57,700	86,475	J-2 Return (South Channel)
2021	51,300	76,982	J-2 Return (South Channel)
2022	43,900	65,789	J-2 Return (South Channel)
2023	No Aug	No Aug	N/A
2024	No Aug	No Aug	N/A

Table of Contents

- Mechanical Management
- **Hydrologic Analysis**
- Hydrodynamic Modeling
- Land Cover Classification
- Volume Change

Hydrologic Analysis

Purpose

- Influence unvegetated width of the channel

Methods

- Mean daily discharge records from USGS stream gages were used to calculate annual metric values

Hydrologic Metrics for Grand Island

Water Year	Mean Annual Discharge (cfs)	Annual Volume (ac-ft)	Mean Daily Peak Discharge (cfs)	Return Interval (Years)	40-Day Max Discharge (cfs)	Mean June flow (germination) (cfs)
2011	4,214	3,050,551	10,200	5.0	7,982	7,866
2012	978	709,915	3,320	1.2	2,857	372
2013	1,024	741,203	10,100	4.8	3,524	366
2014	1,199	867,919	8,120	3.2	2,778	3,290
2015	3,341	2,418,835	16,000	16.3	12,636	13,370
2016	2,993	2,172,692	8,750	3.6	7,390	6,624
2017	1,585	1,147,311	4,560	1.5	2,943	2,099
2018	1,498	1,084,572	3,010	1.2	2,036	1,450
2019	3,006	2,176,268	18,200	26.0	4,615	3,769
2020	2,005	1,455,474	9,310	4.1	3,755	2,016
2021	1,127	815,662	5,560	1.8	2,437	1,599
2022	613	443,952	2,410	1.1	1,281	1,513
2023	1,116	807,597	6,430	2.2	3,641	3,100
2024	1,073	778,878	3,500	1.3	1,976	1,791

Hydrologic Analysis of Germination Suppression flows

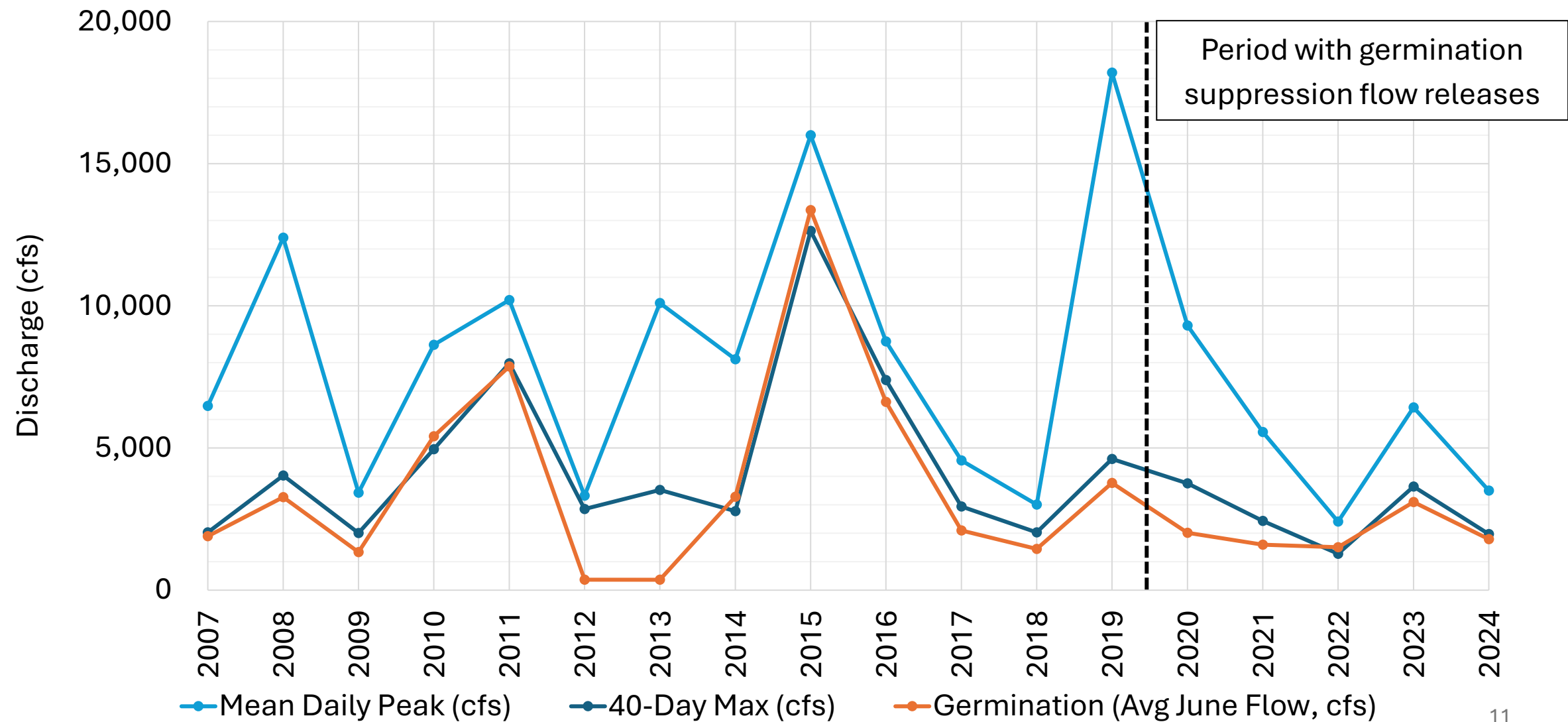


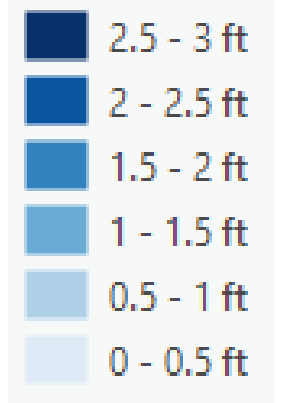
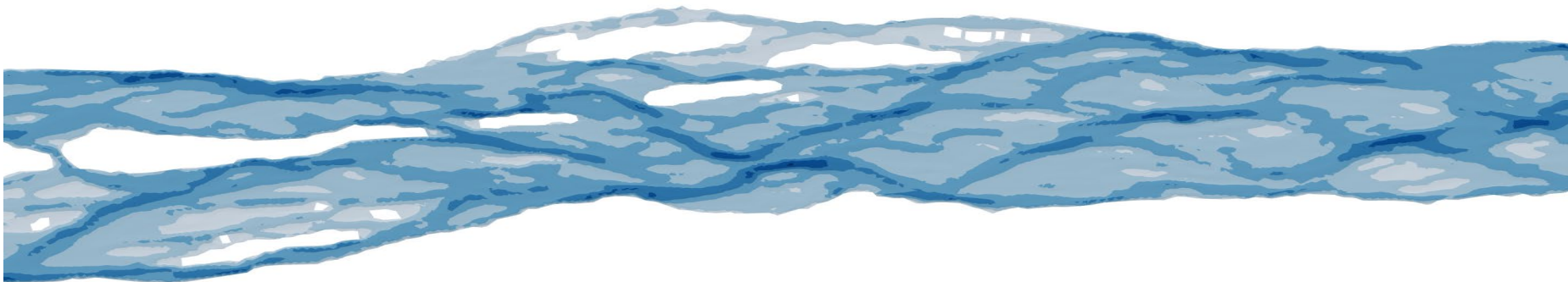
Table of Contents

- Mechanical Management
- Hydrologic Analysis
- **Hydrodynamic Modeling**
- Land Cover Classification
- Volume Change

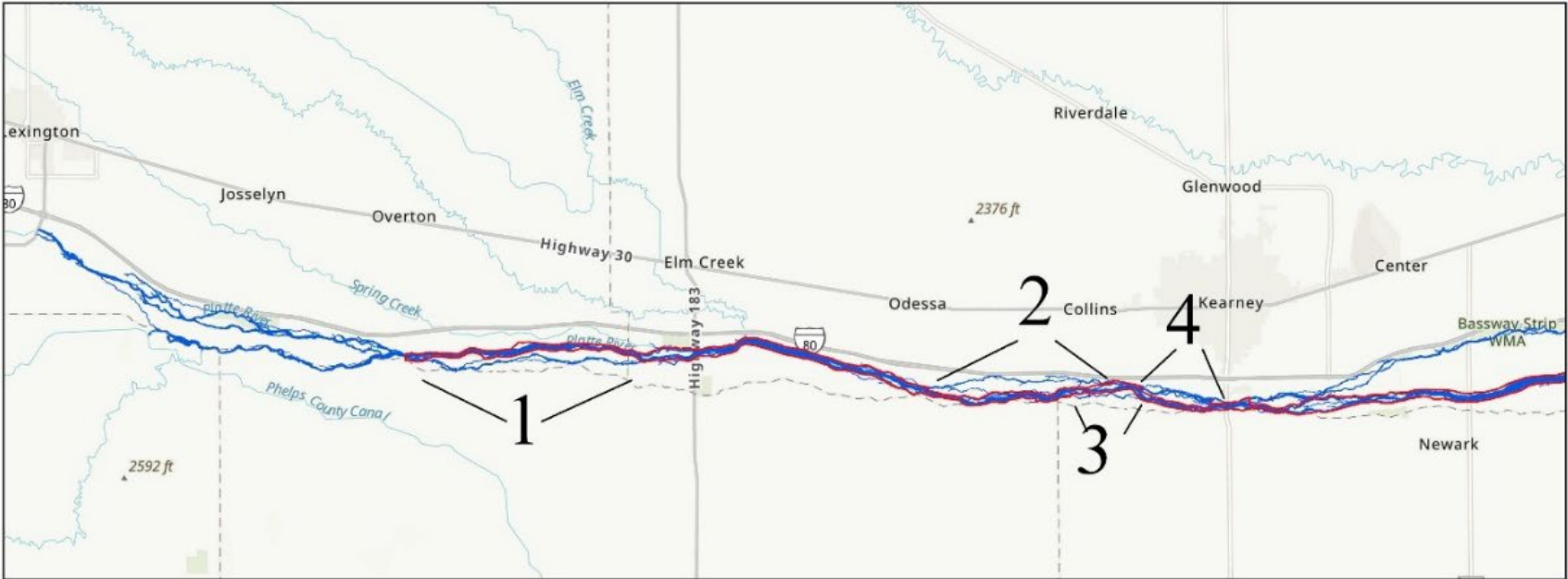
Hydrodynamic Modeling

Methods

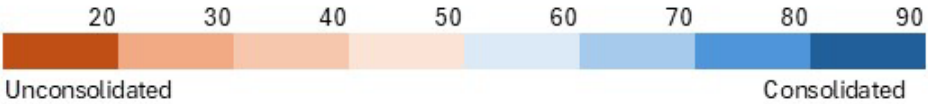
- LiDAR is used to create HEC-RAS 2D hydraulic models
- Flows from 500 to 5,000 cfs
- Validated using measured water surface elevations



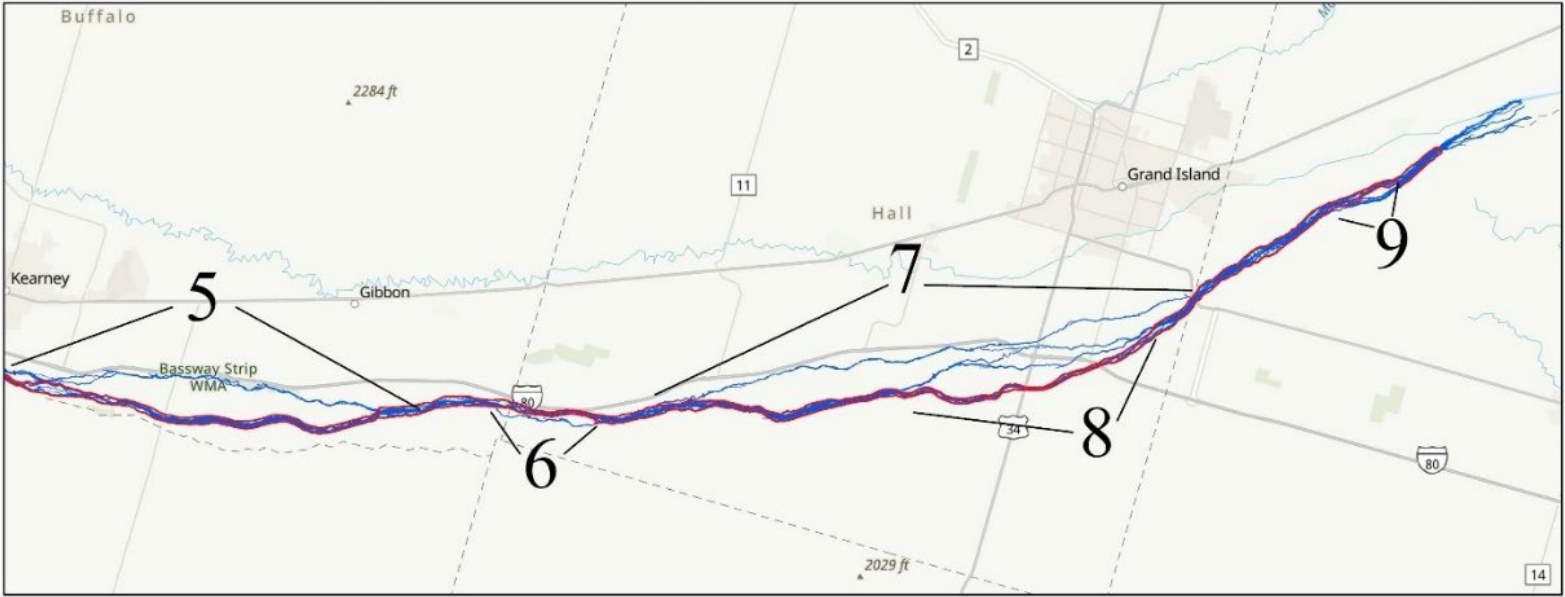
Flow Splits



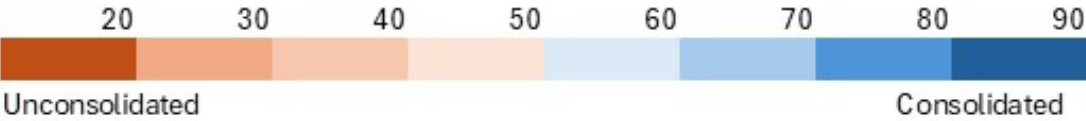
#	Location/Description	2016	2017	2018	2019	2020	2021	2022	2023	2024	Trend
1	Overton to Elm Creek; South side channel at Cottonwood Ranch	82%	73%	56%	50%	60%	63%	48%	51%	65%	Reduced Consolidation



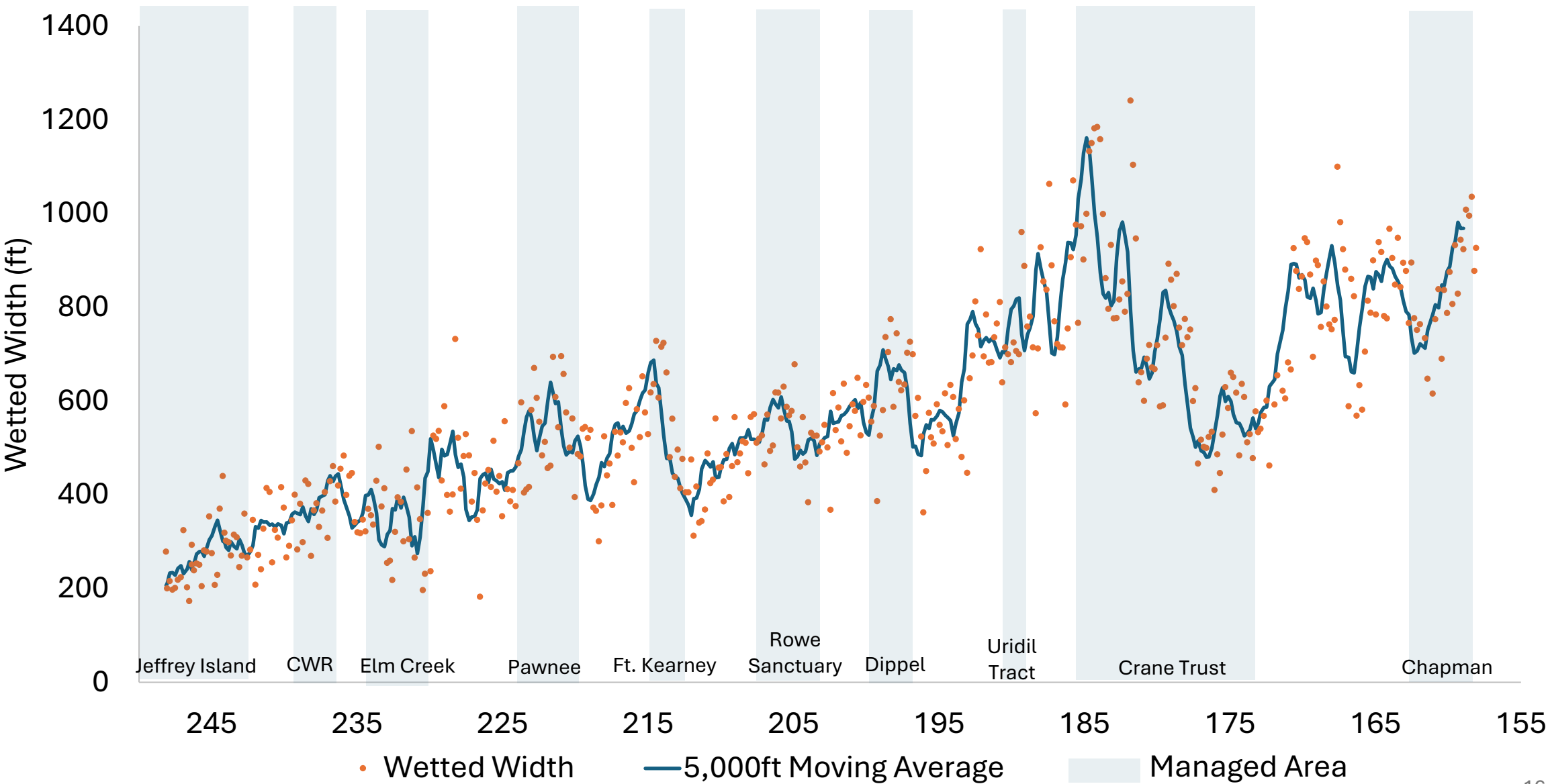
Flow Splits



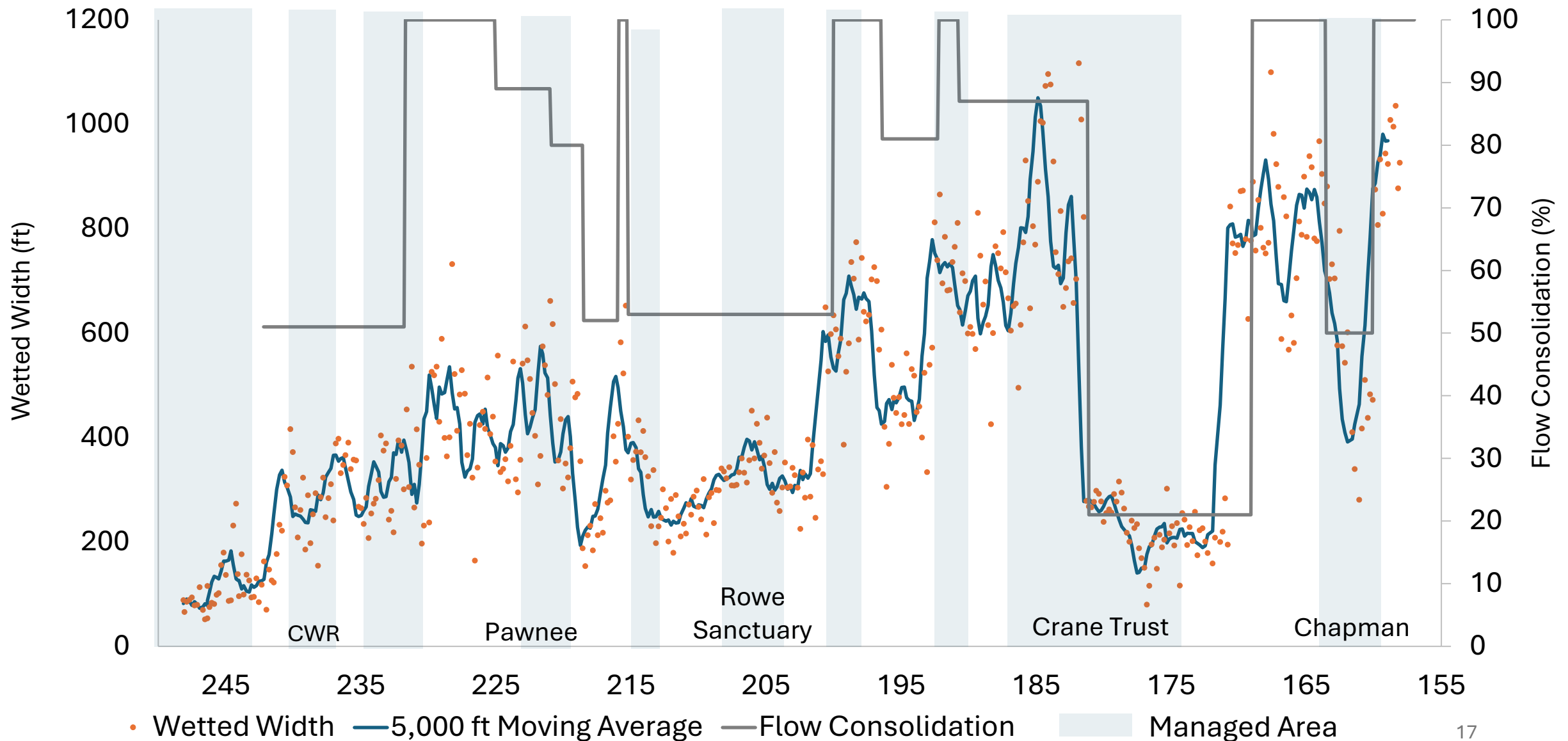
#	Location/Description	2016	2017	2018	2019	2020	2021	2022	2023	2024	Trend
5	Kearney to Gibbon; North side channel	38%	43%	50%	57%	53%	53%	57%	53%	54%	Increased Consolidation
8	Mormon Island to Grand Island; Second north side channel	22%	22%	22%	22%	18%	24%	21%	21%	20%	No Trend, SC Dominant



2024 Wetted Width of All Channels



2024 Wetted width of the Main Channel



Wetted Width by Managed Area

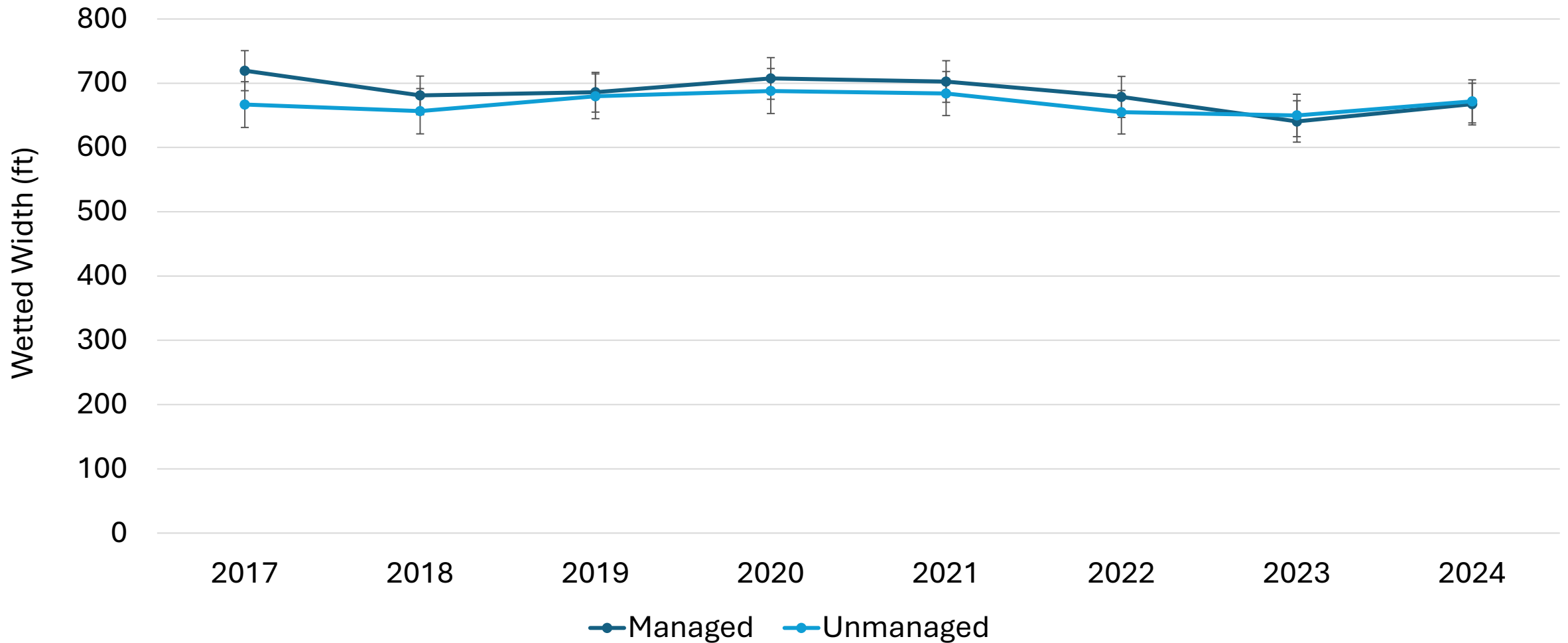
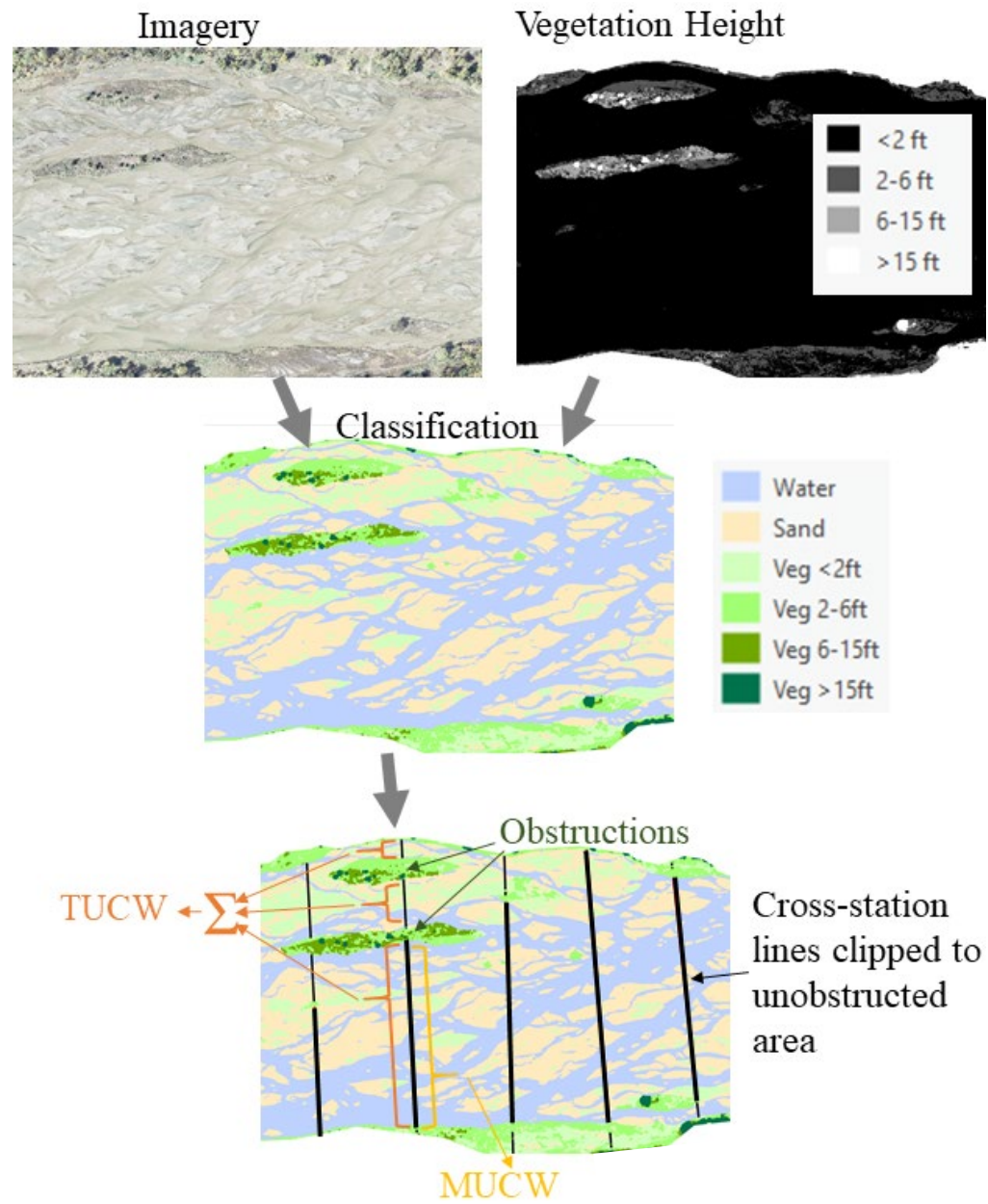


Table of Contents

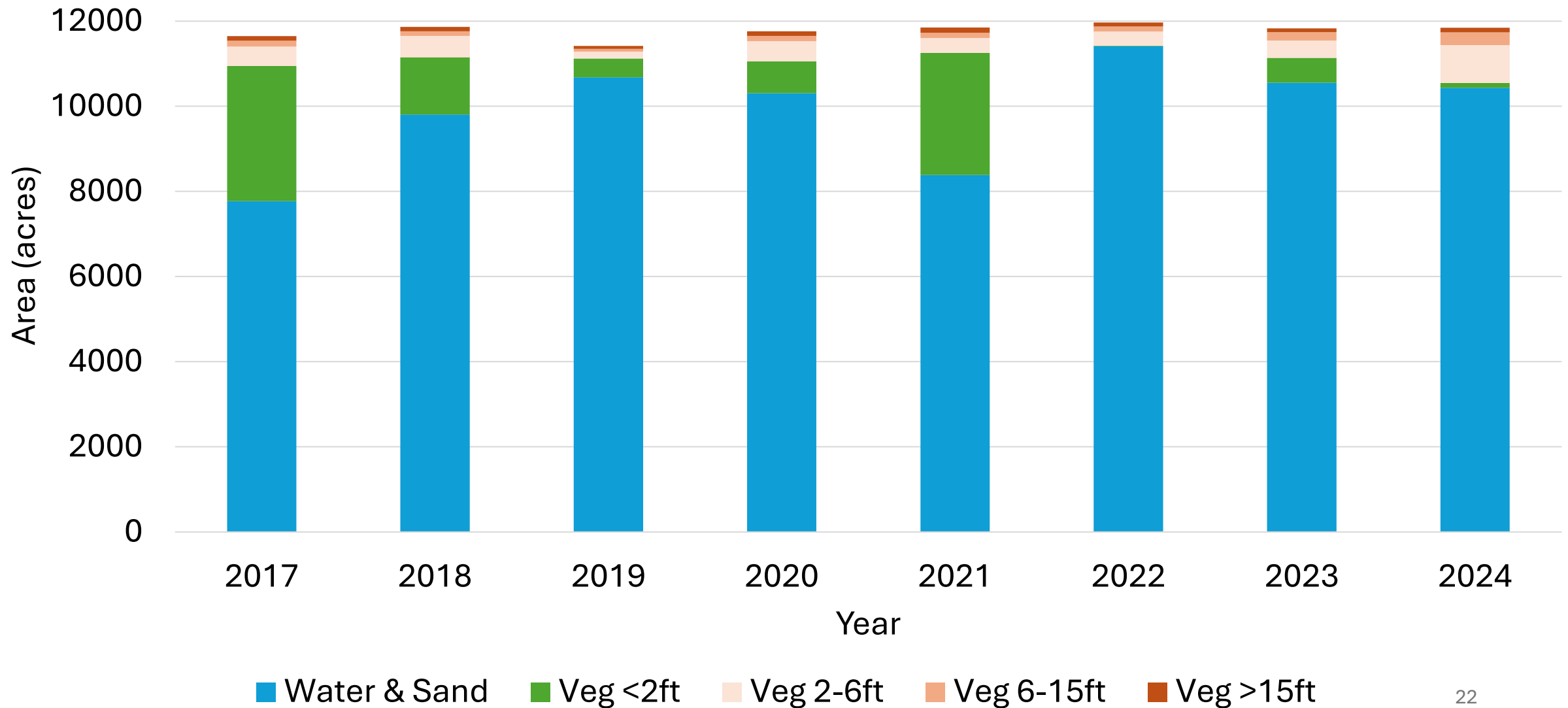
- Mechanical Management
- Hydrologic Analysis
- Hydrodynamic Modeling
- **Land Cover Classification**
- Volume Change

Land Cover Classification Classes

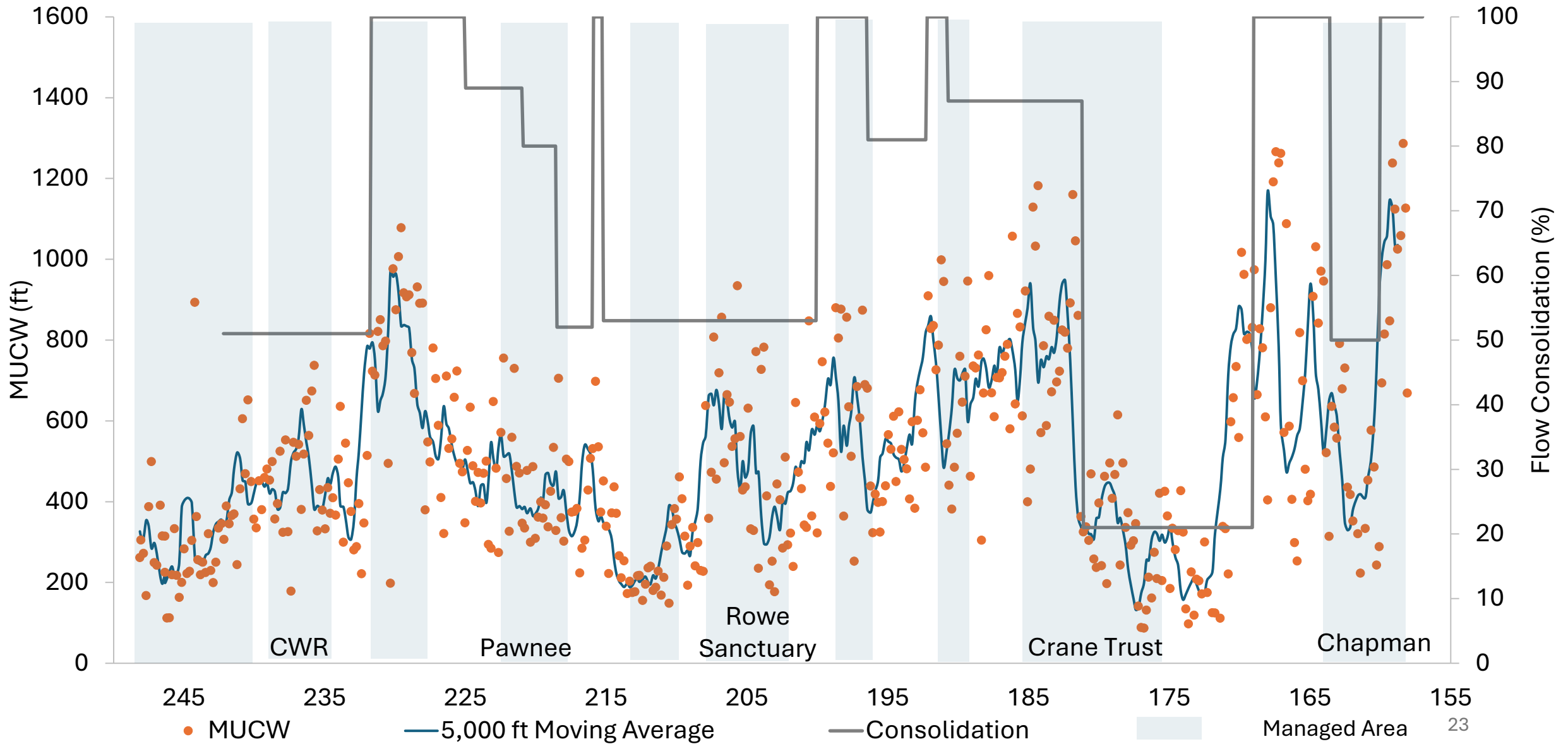
Land Cover Class	Obstructed/Unobstructed
Sand	Unobstructed
Water	Unobstructed
Vegetation < 2ft	Unobstructed
Vegetation 2 - 6 ft	Obstructed
Vegetation 6 - 15 ft	Obstructed
Vegetation > 15 ft	Obstructed



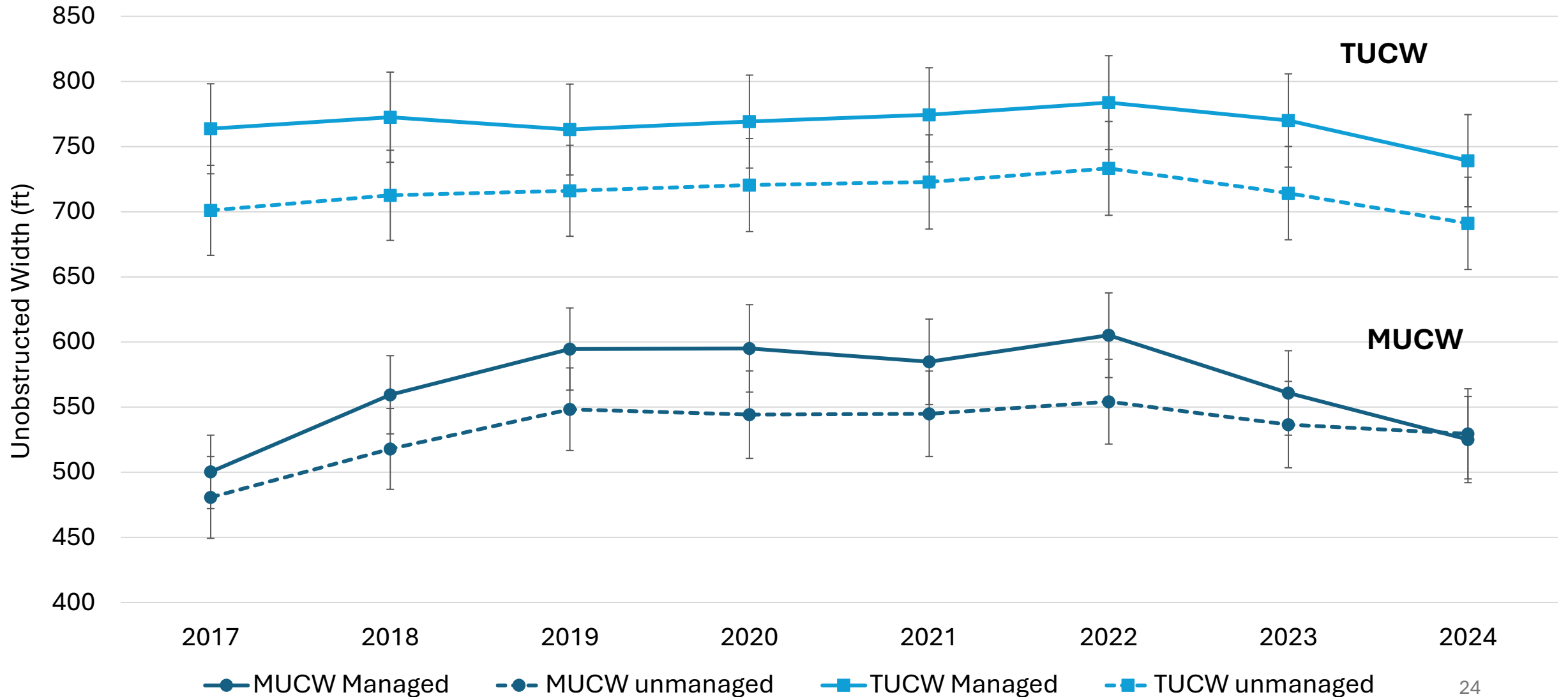
Total Area of Land Cover Class by year



2024 MUCW in the Main Channel



Mean MUCW and TUCW for Main Channel



Hydrologic Metrics and Main Channel TUCW

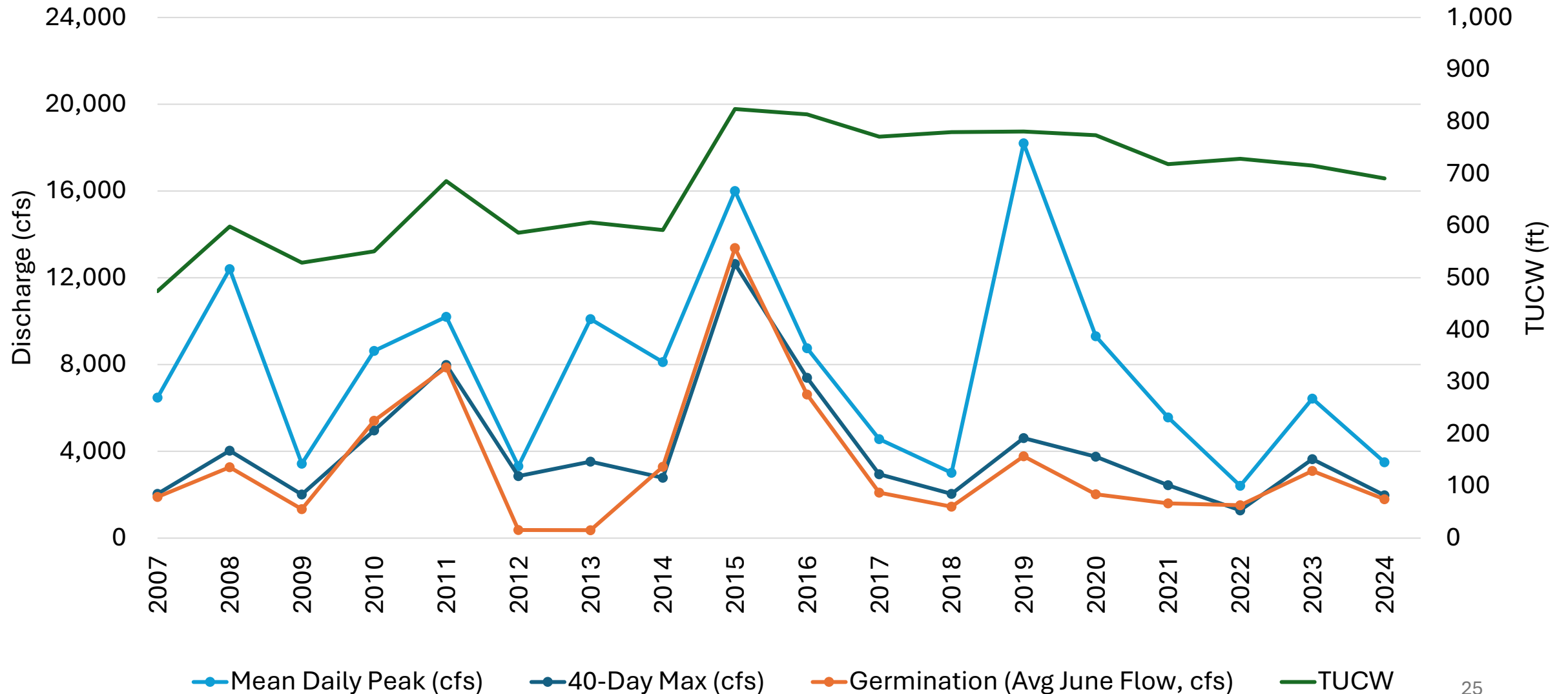


Table of Contents

- Mechanical Management
- Hydrologic Analysis
- Hydrodynamic Modeling
- Land Cover Classification
- **Volume Change**

Volume Change

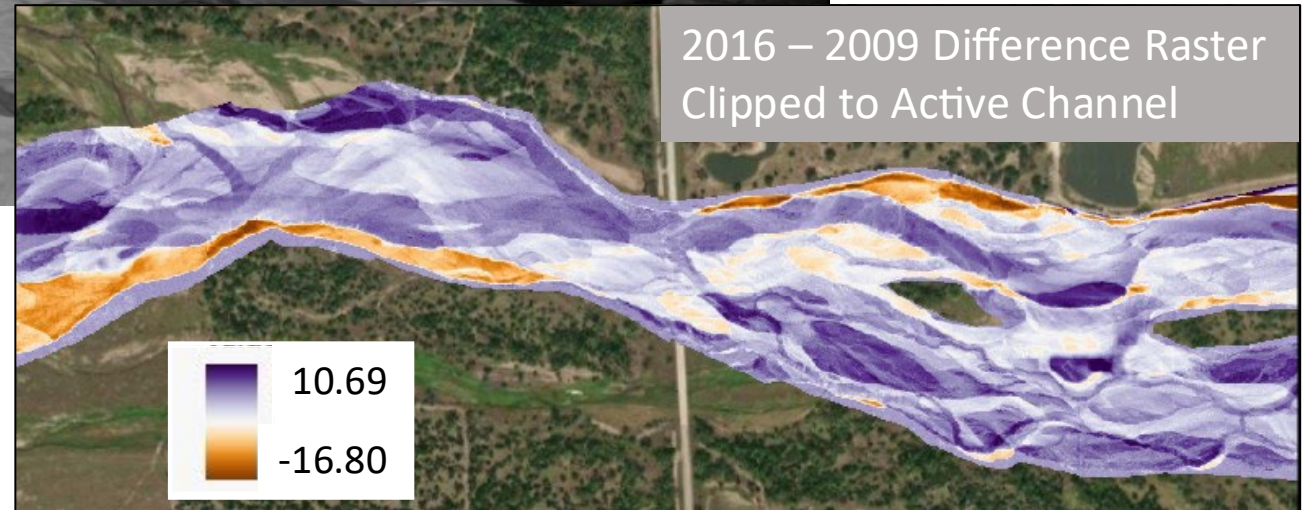
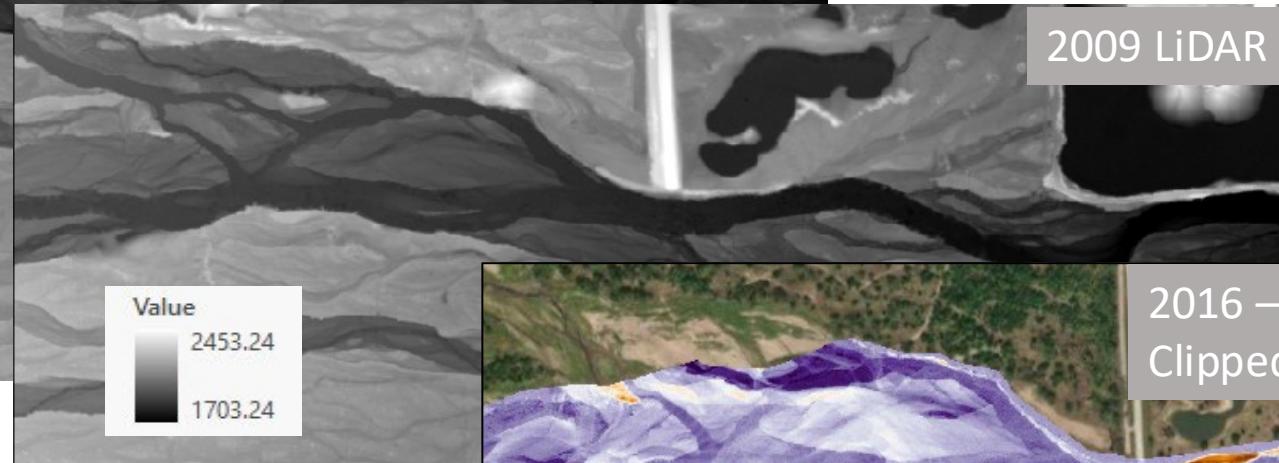
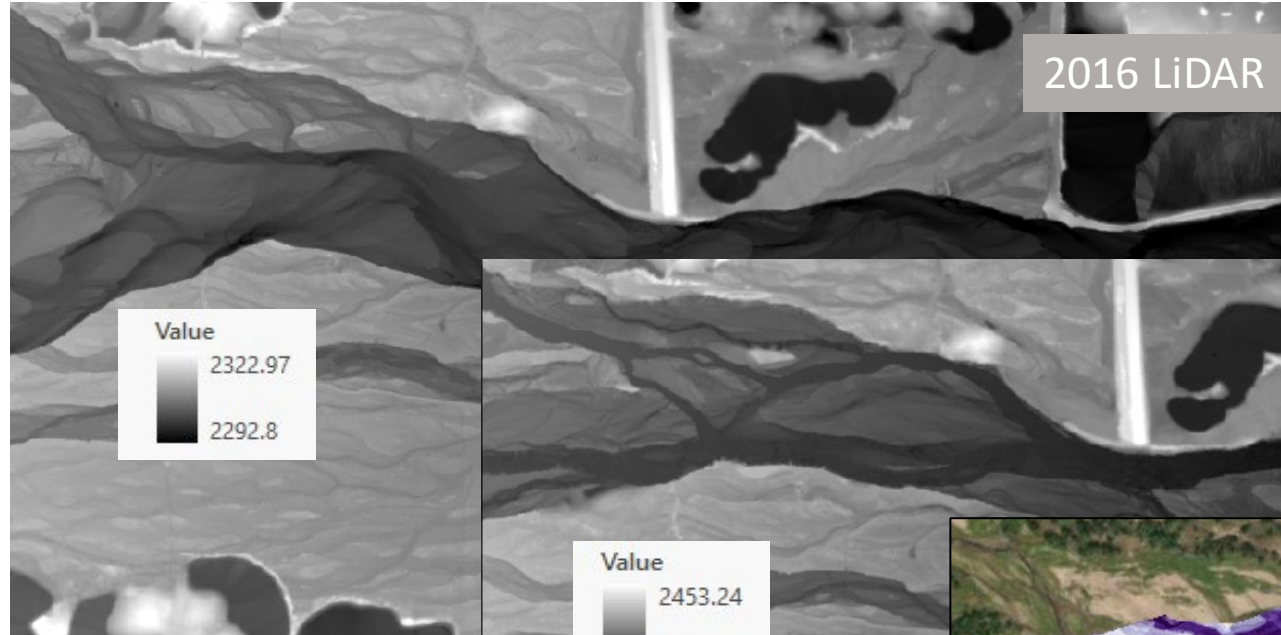
Purpose

- Monitor erosion, degradation, and aggradation
- Channel degradation can lead to narrowing and habitat loss



Volume Change Analysis Methods-

Creating clipped difference rasters



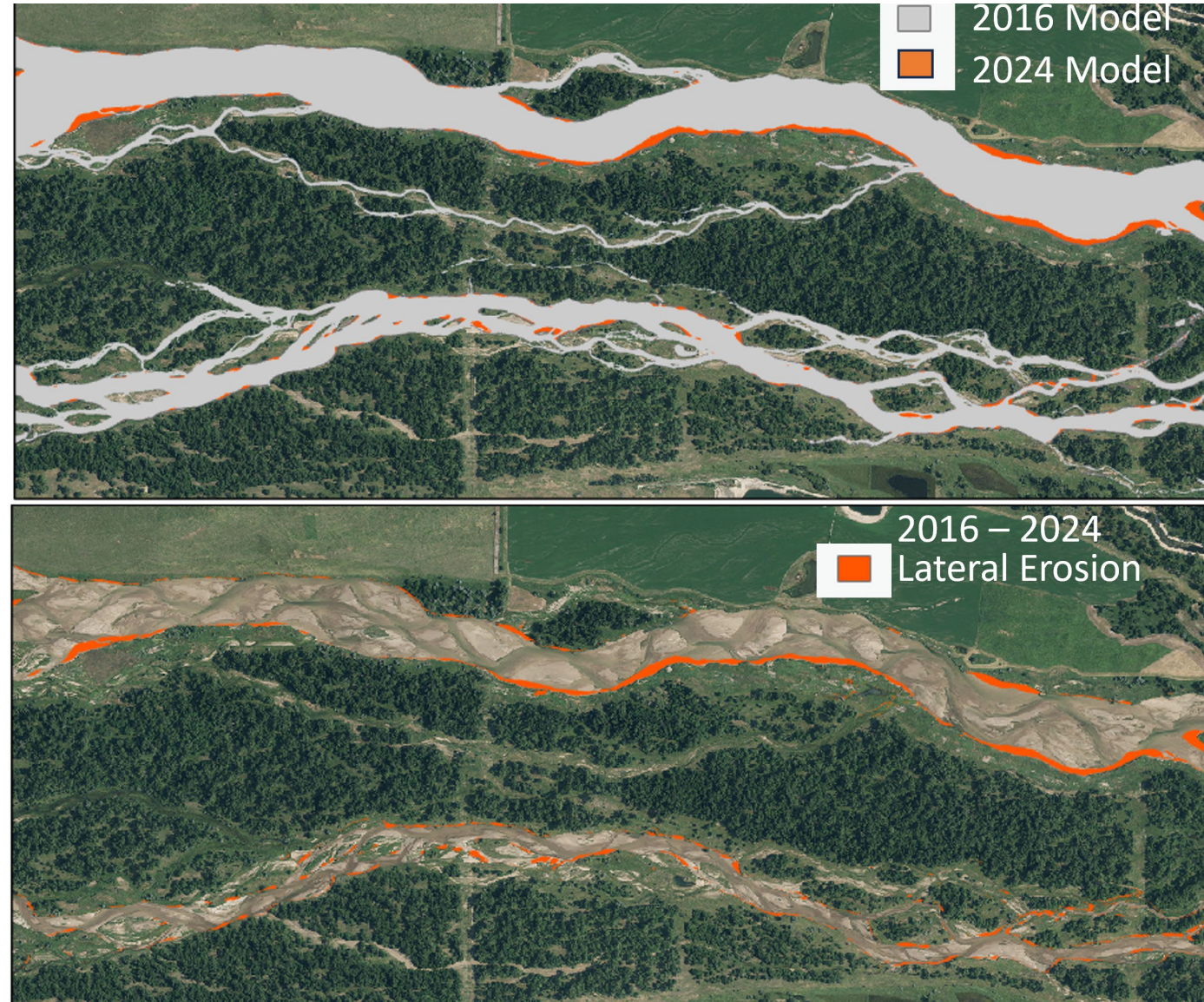
Volume Change Analysis Methods-

Isolating Bed Erosion/Aggradation

$$\text{Bed Volume Change} = \text{Total Volume Change} - \text{Lateral Erosion}$$

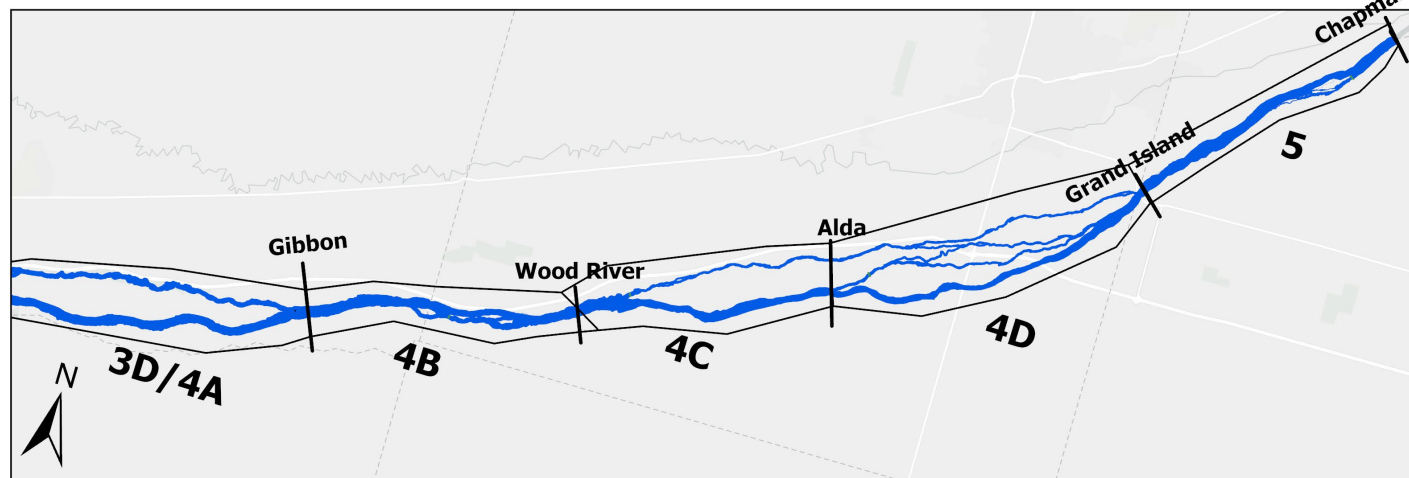
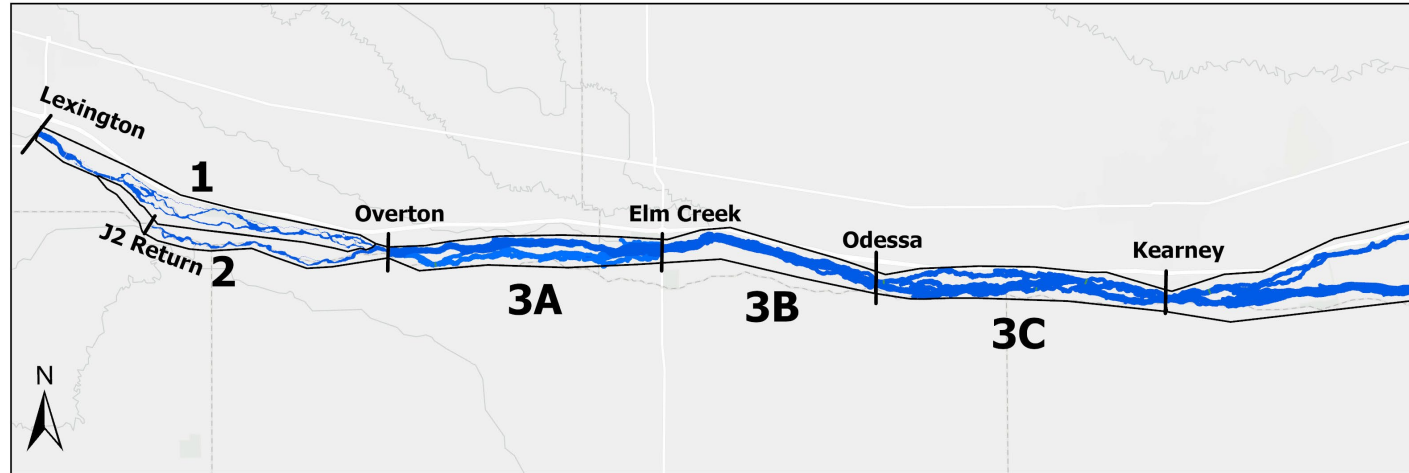
Volume Change Analysis Methods-

Delineating lateral erosion

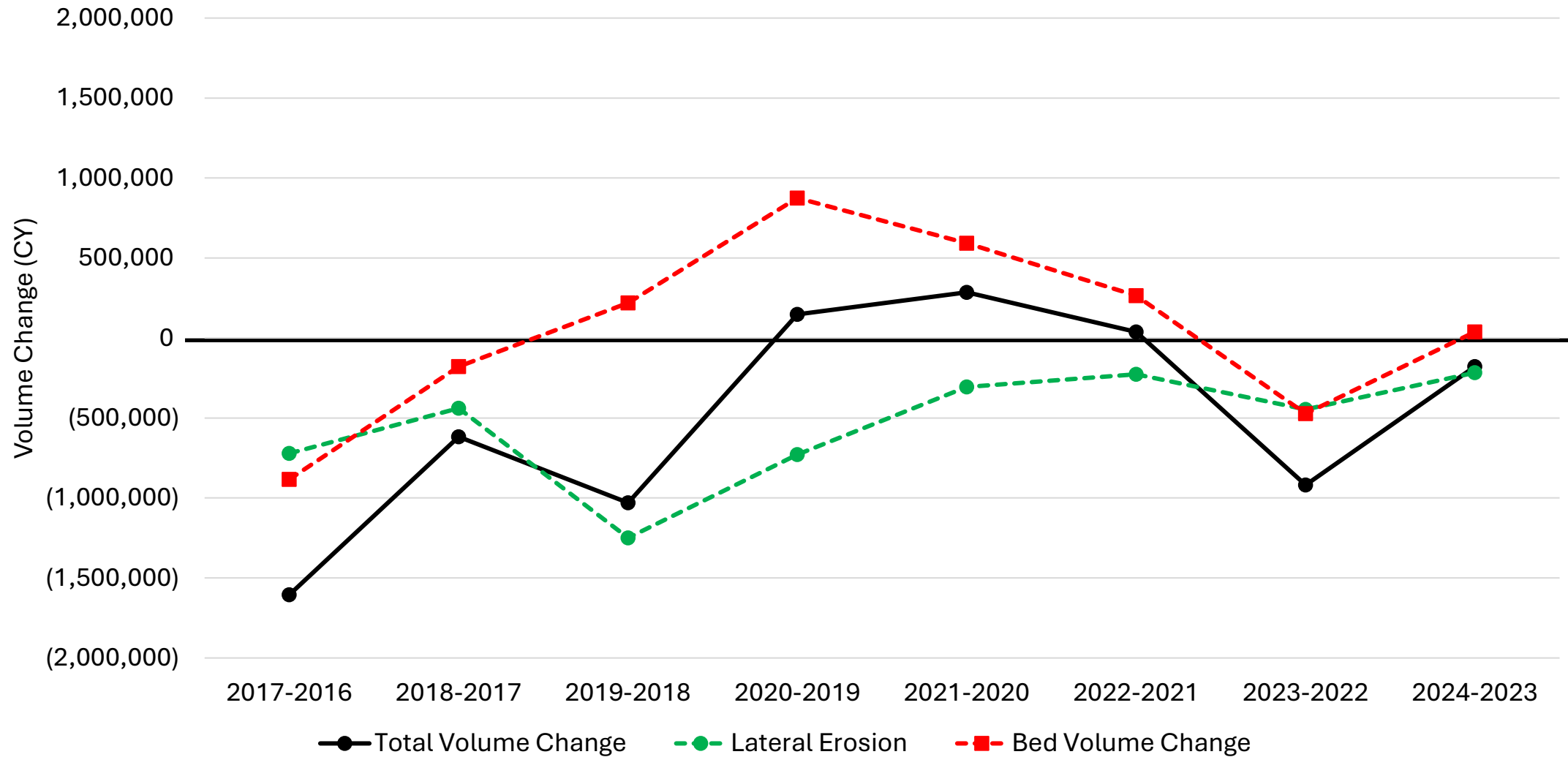


Volume Change Analysis Methods-

*Summing change over each reach and
converting to volume*

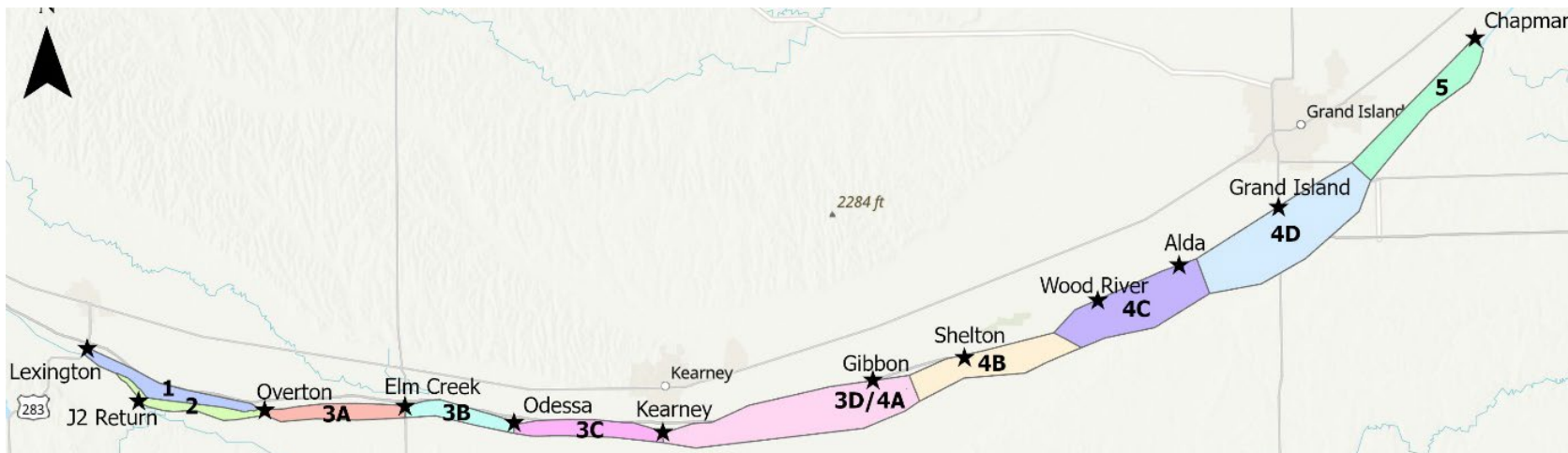


Volume Change by Year



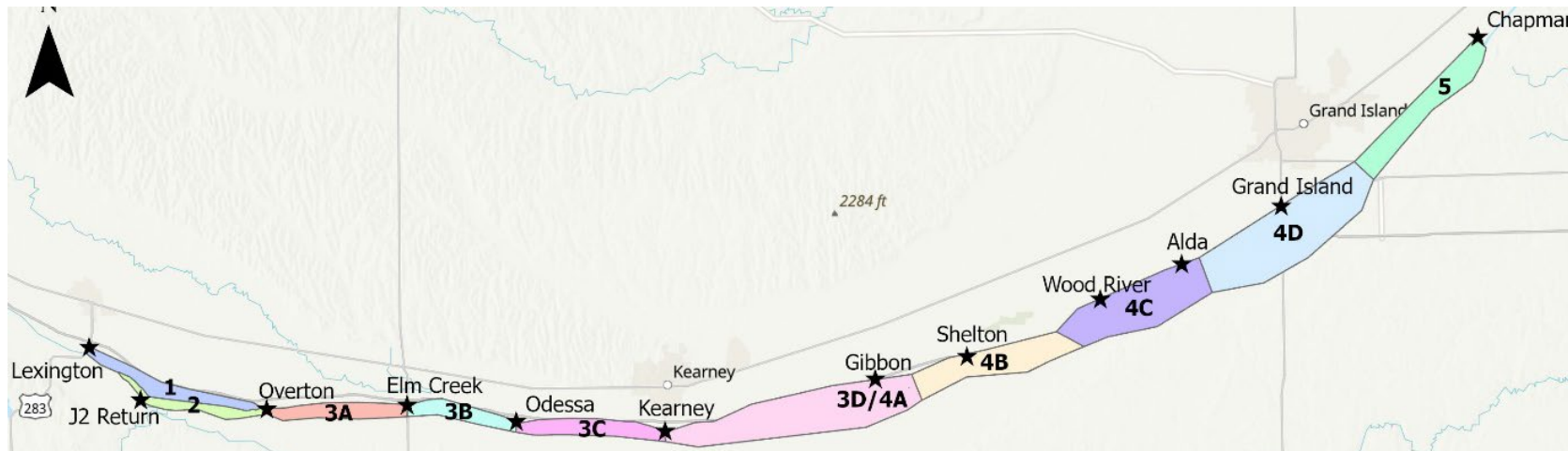
Total Volume Change (CY) in the Main Channel by Reach

Year/Reach	17-16	18-17	19-18	20-19	21-20	22-21	23-22	24-23	24-16
1	59,029	(26,485)	(6,771)	(21,523)	68,692	13,374	(152,397)	44,187	(24,746)
2	(138,150)	(174,351)	(221,029)	(111,441)	(95,721)	(81,226)	(85,480)	(101,206)	(980,552)
3A	(18,876)	(97,391)	(69,783)	(26,231)	19,058	(29,225)	(86,465)	(69,349)	(383,886)
3B	(81,321)	(109,231)	(111,236)	(29,235)	(27,344)	(28,853)	(68,574)	(41,958)	(503,643)
3C	(33,115)	(105,226)	(108,030)	(13,544)	16,360	5,817	(64,580)	(5,845)	(323,854)
3D/4A	(115,901)	(165,813)	(81,620)	46,555	73,230	67,558	(159,073)	121,744	(230,510)
4B	(259,485)	110,359	(139,411)	105,415	25,093	38,678	(71,556)	(15,111)	(200,285)
4C	(252,508)	114,739	(133,737)	135,781	(8,298)	23,434	(65,993)	(66,103)	(266,698)
4D	(39,545)	(26,003)	(1,106)	81,427	17,204	24,534	(15,263)	(20,583)	16,378
5	(242,250)	(154,972)	(9,586)	(16,846)	58,545	(23,978)	(63,385)	(35,105)	(480,945)
Total	(1,122,122)	(634,372)	(882,310)	150,358	146,820	10,111	(809,729)	(184,802)	(3,333,263)

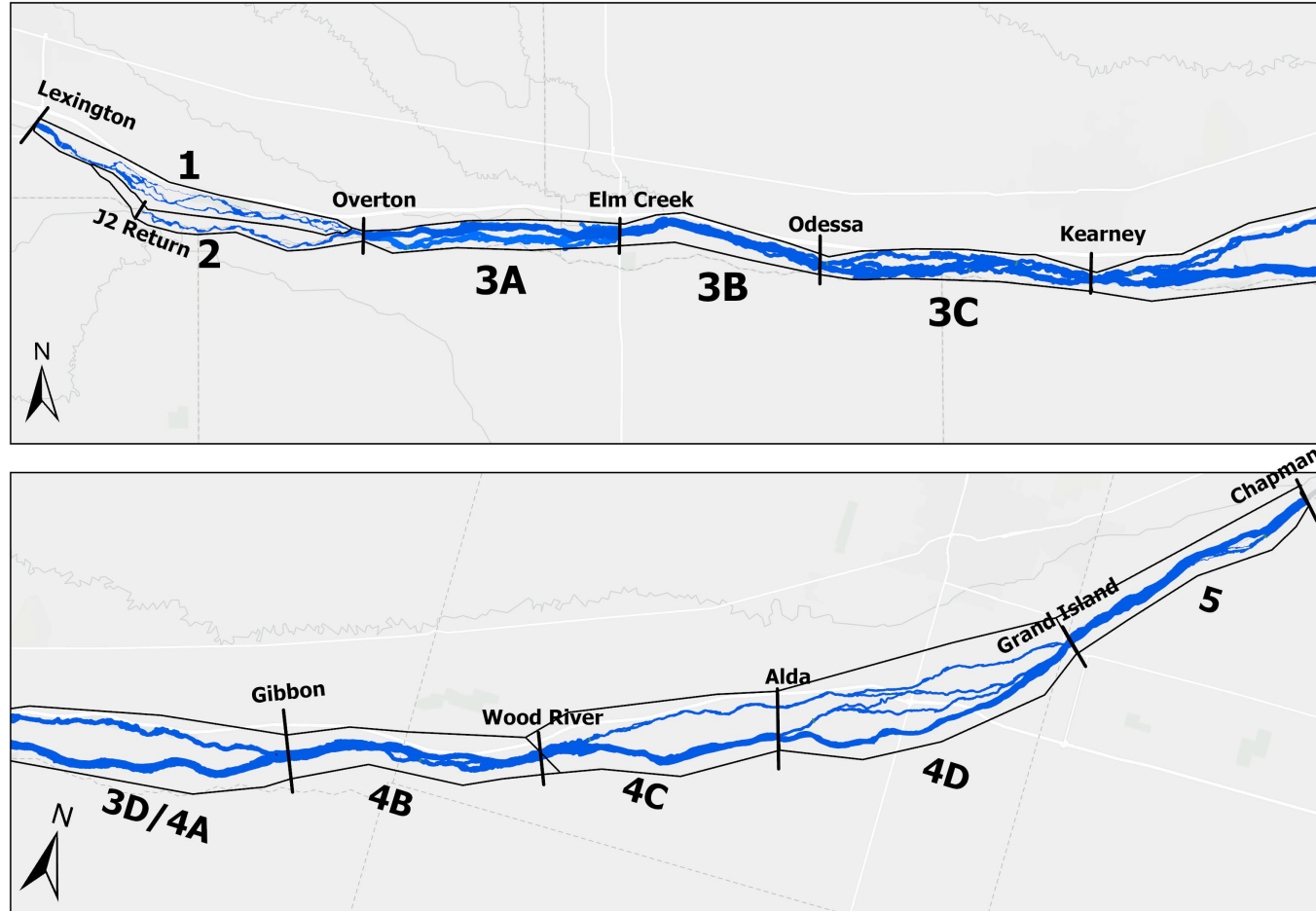


Bed Volume Change in the Main Channel by Reach

Year/Reach	17-16	18-17	19-18	20-19	21-20	22-21	23-22	24-23	24-16
1	97,111	(7,417)	25,371	4,317	75,368	21,729	(54,075)	53,914	205,989
2	60,462	(71,197)	(104,620)	1,216	11,620	3,409	(20,246)	(51,557)	(108,267)
3A	6,397	(72,831)	(17,439)	6,631	35,651	(17,486)	(56,338)	(55,996)	(118,983)
3B	(48,526)	(88,353)	(45,233)	13,815	(7,001)	(12,367)	(43,574)	(30,767)	(233,563)
3C	5,884	(73,519)	4,035	32,664	41,597	25,138	(23,546)	11,906	58,663
3D/4A	(55,505)	(130,992)	10,420	103,556	89,303	76,066	(143,819)	133,435	41,990
4B	(202,202)	146,910	(3,189)	163,256	44,739	50,711	(43,461)	115	189,791
4C	(215,656)	132,831	(80,320)	184,961	(2,880)	31,389	(52,326)	(50,913)	(58,794)
4D	(6,089)	(12,194)	42,401	128,615	27,768	31,374	(6,750)	(7,273)	156,828
5	(193,722)	(117,151)	132,643	69,126	78,871	(12,566)	(44,647)	(20,707)	(120,519)
Total	(551,845)	(293,912)	(35,929)	708,156	395,036	197,396	(462,864)	(12,996)	69,675

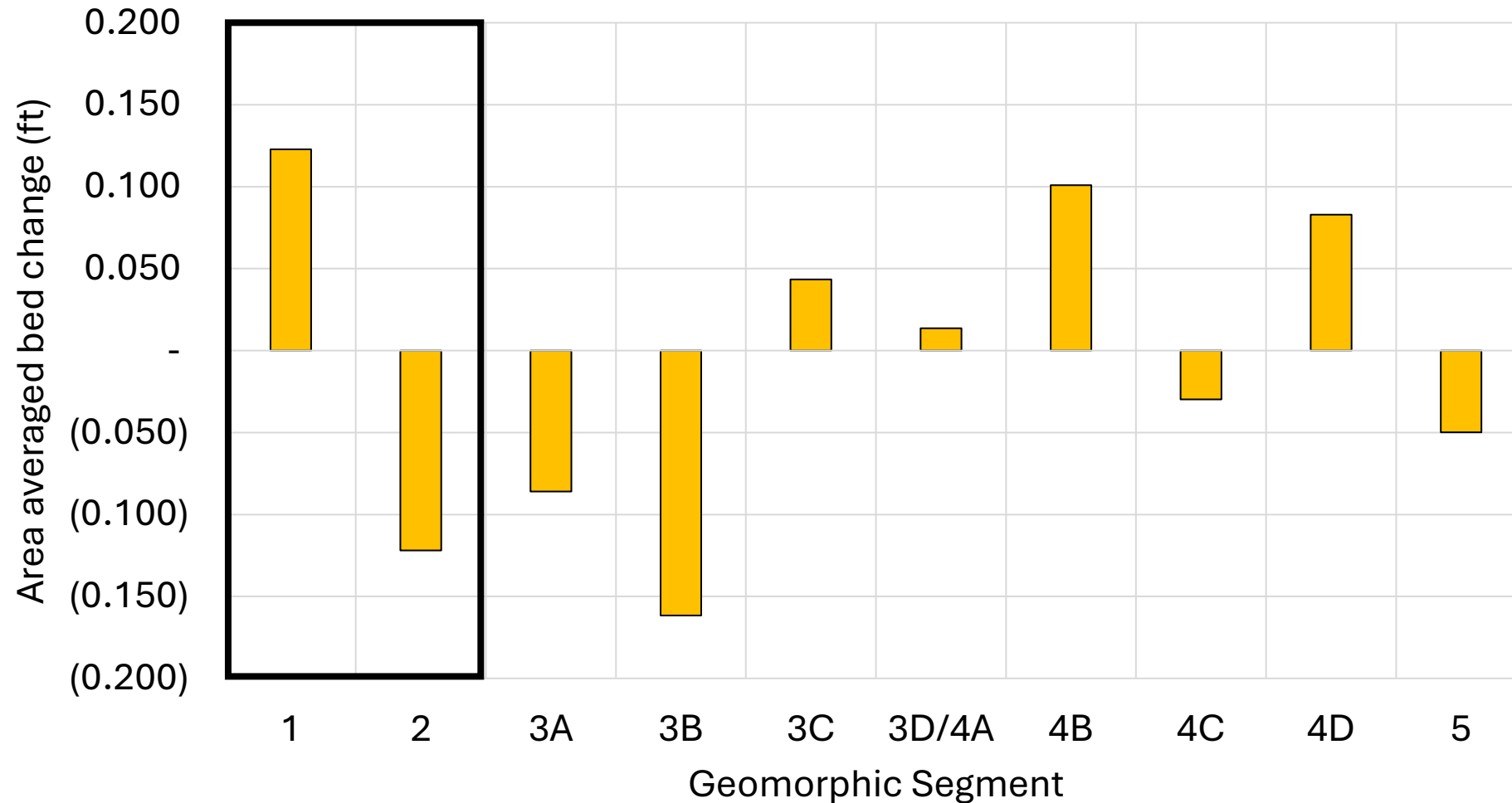


Standardizing volume change by reach

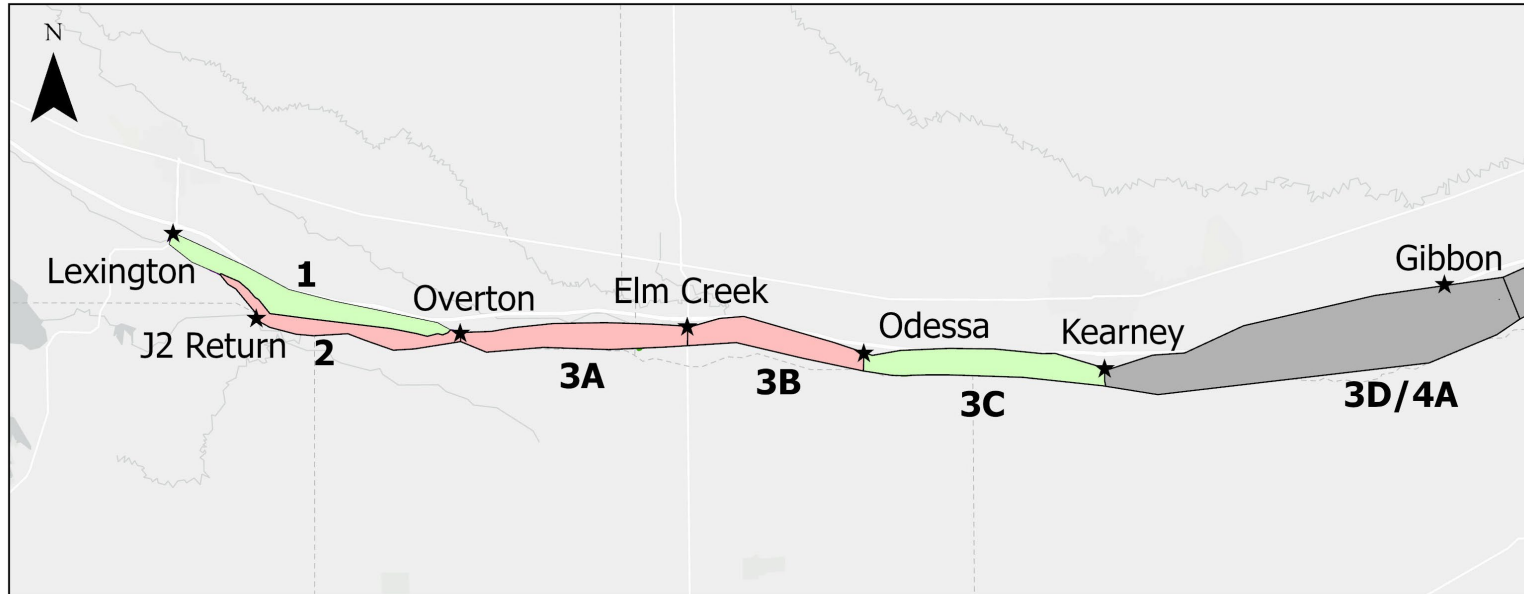


$$\text{Area Averaged Change (ft)} = \frac{\text{Volume Change (ft}^3\text{)}}{\text{Reach Area (ft}^2\text{)}}$$

Bed Volume Change in the Main Channel Normalized by Wetted Area from 2016 to 2024

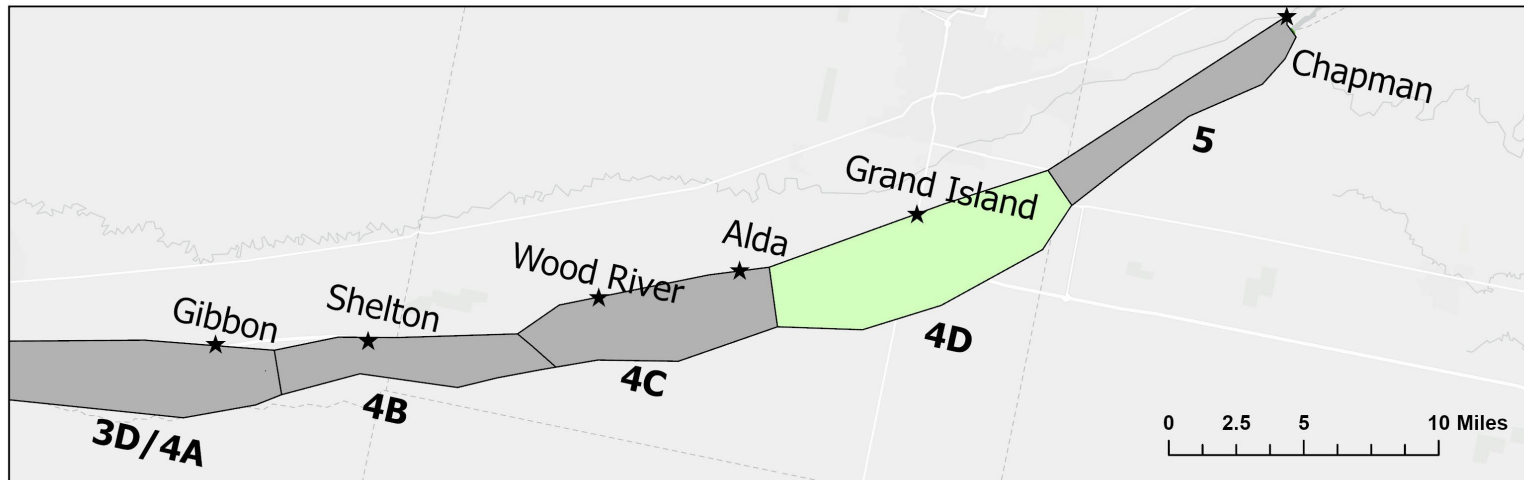


Statistical Significance of trends in Area Averaged Bed Change for 2016 - 2024



Green indicates aggradational trend

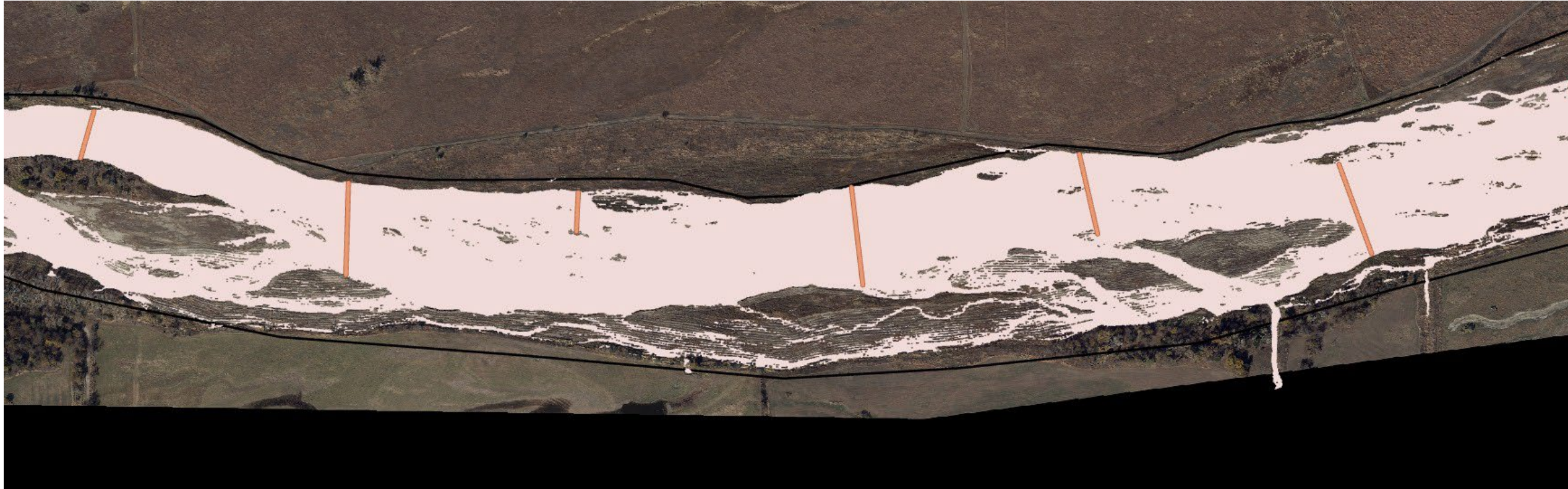
Red indicates degradational trend



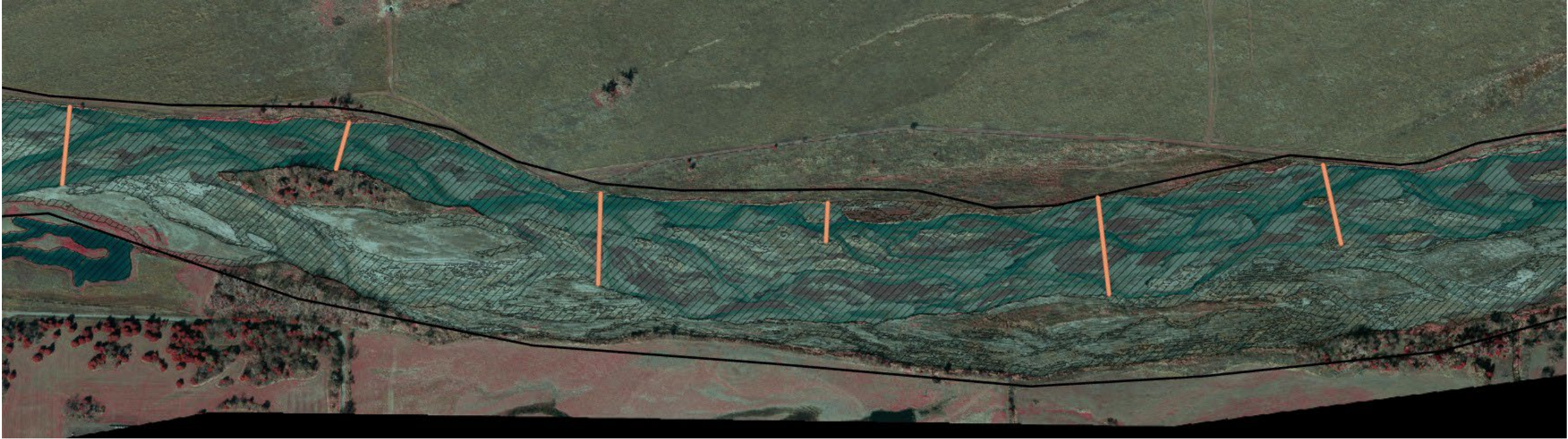
Questions?

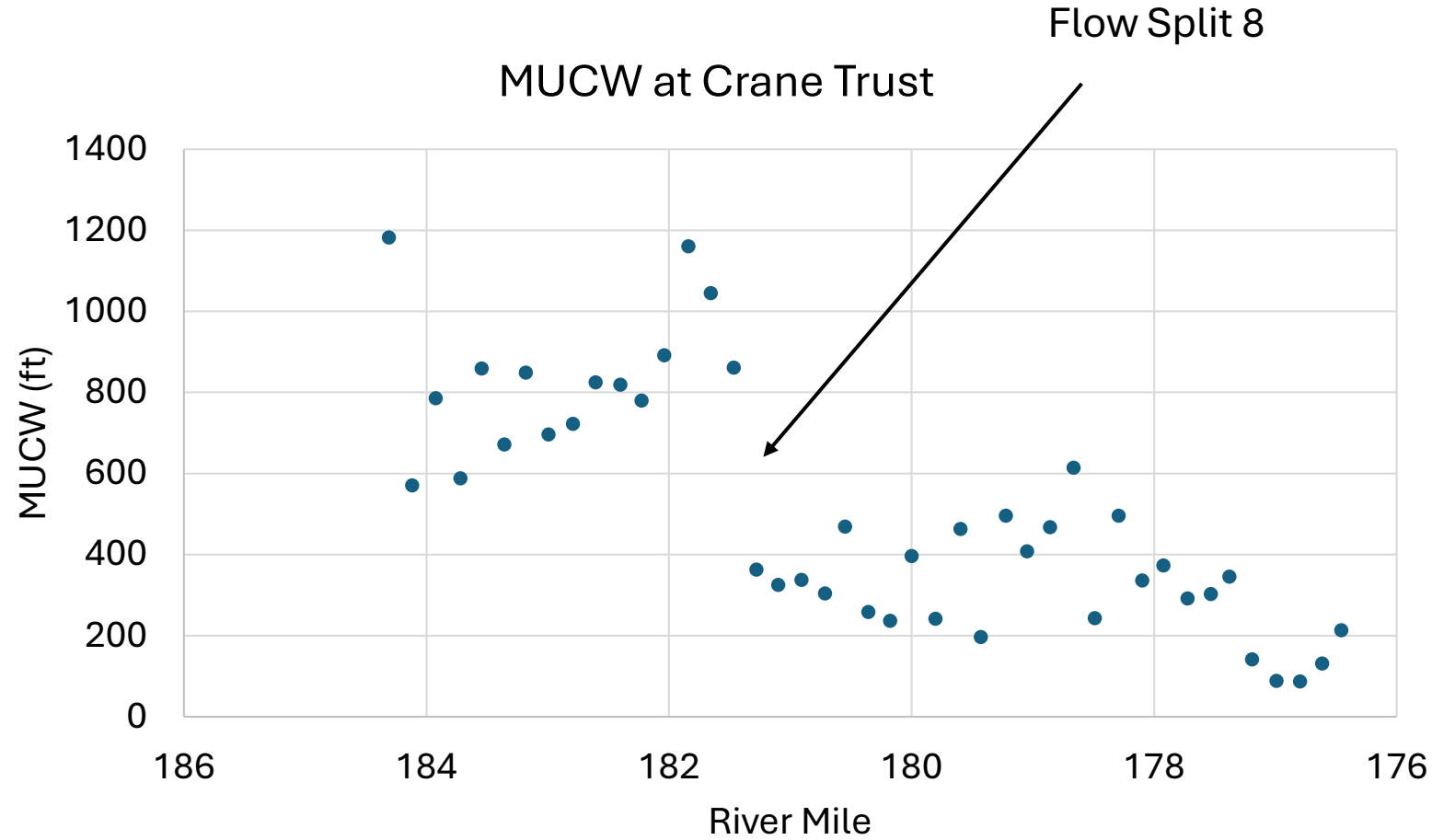
- Mechanical Management
- Hydrologic Analysis
- Hydrodynamic Modeling
- Land Cover Classification
- Volume Change

Crane Trust Widths



- Average widths: 510
- Max width: 1182





- Widths decrease going downstream – less flow

8	Mormon Island to Grand Island; Second north side channel	22%	22%	22%	22%	18%	24%	21%	21%	20%	No Trend, SC Dominant
---	----------------------------------------------------------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----------------------



