Low Velocity Habitat and Island Monitoring 2013 and 2014

Presented By

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Ecosystems Research Institute

Background in LRP

- *Goal 2.1—Provide Suitable Habitat to Support Recovery of CPM and RBS Populations.*

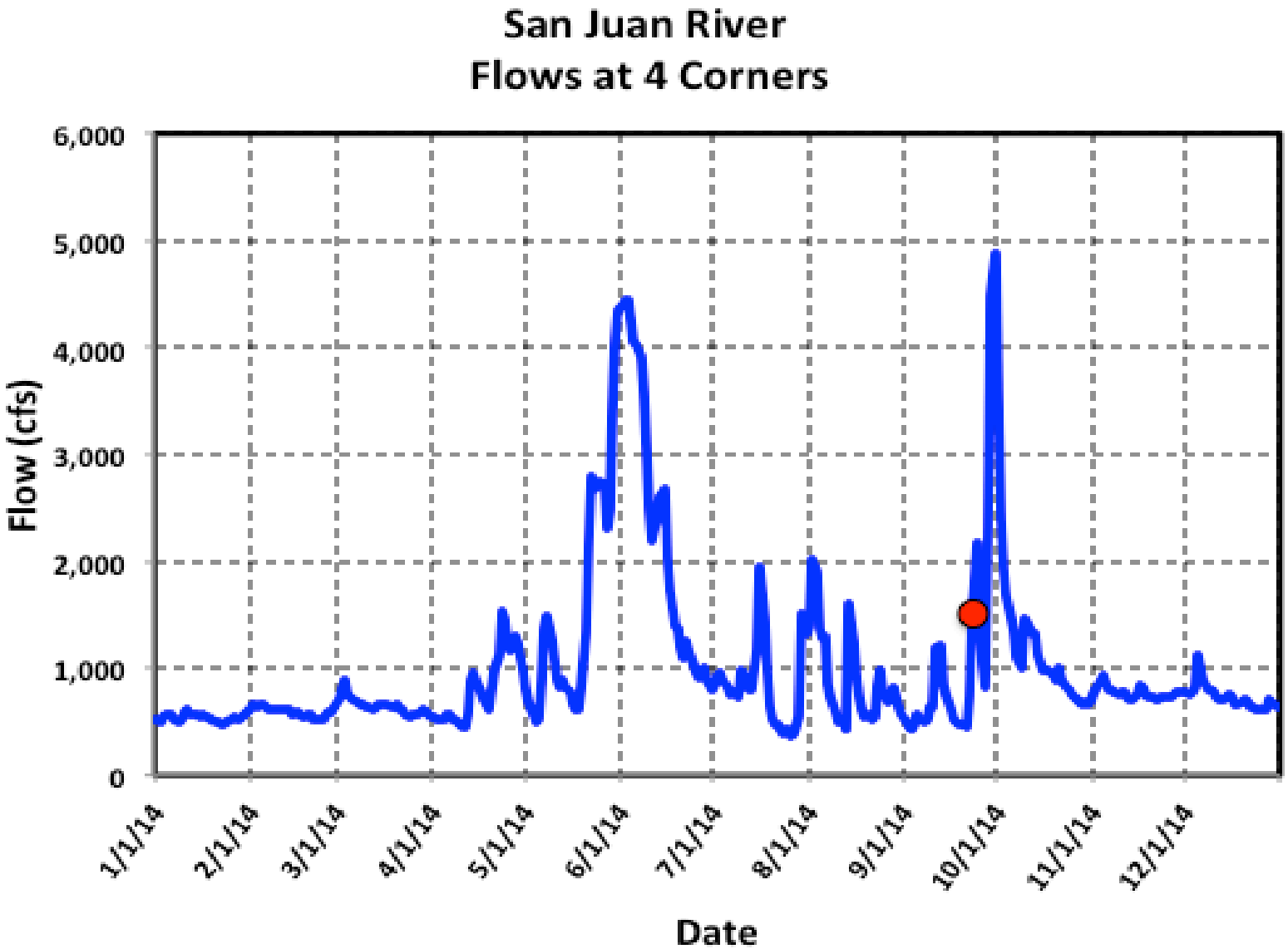
- *Goal 4.2—Monitor Habitat Use and Availability.*

Habitat Documentation

- **Results**
  - ► **Spatial Differences in Backwaters in 2013-14**
  - ► **Historical Differences in Backwaters compared to 2013-14**
  - ► **Historical Differences in Backwaters compared to POR**
- **Initial Integration Analysis**
  - ► **Loss of Base flow TWA**
  - ► **Definition and Historical Review of the Multiple Channels System**
  - ► **Hypothesis Testing**
- **Future Integration**
- **Conclusions**

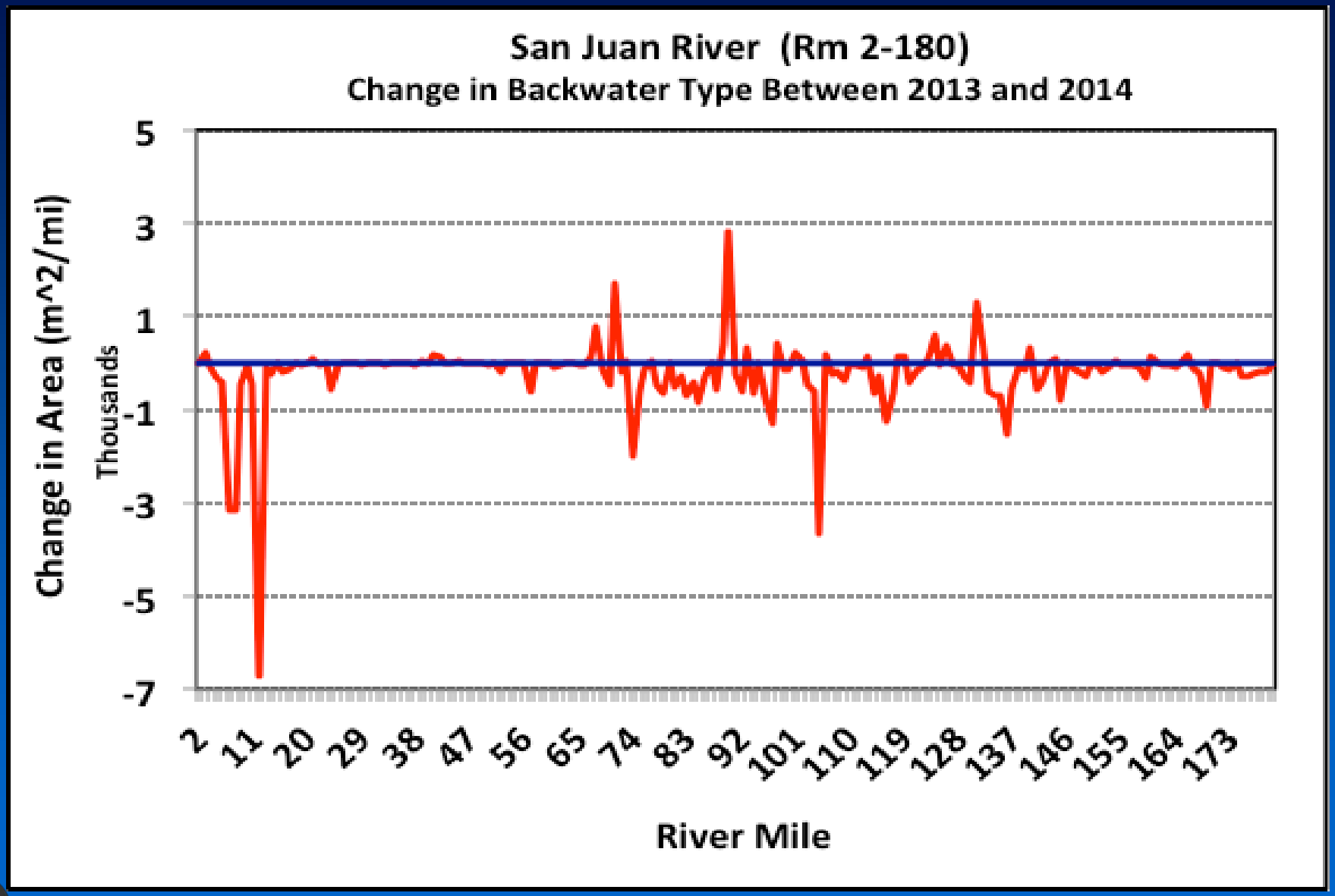
2014 Results

2014 Mapping Hydrologic Conditions



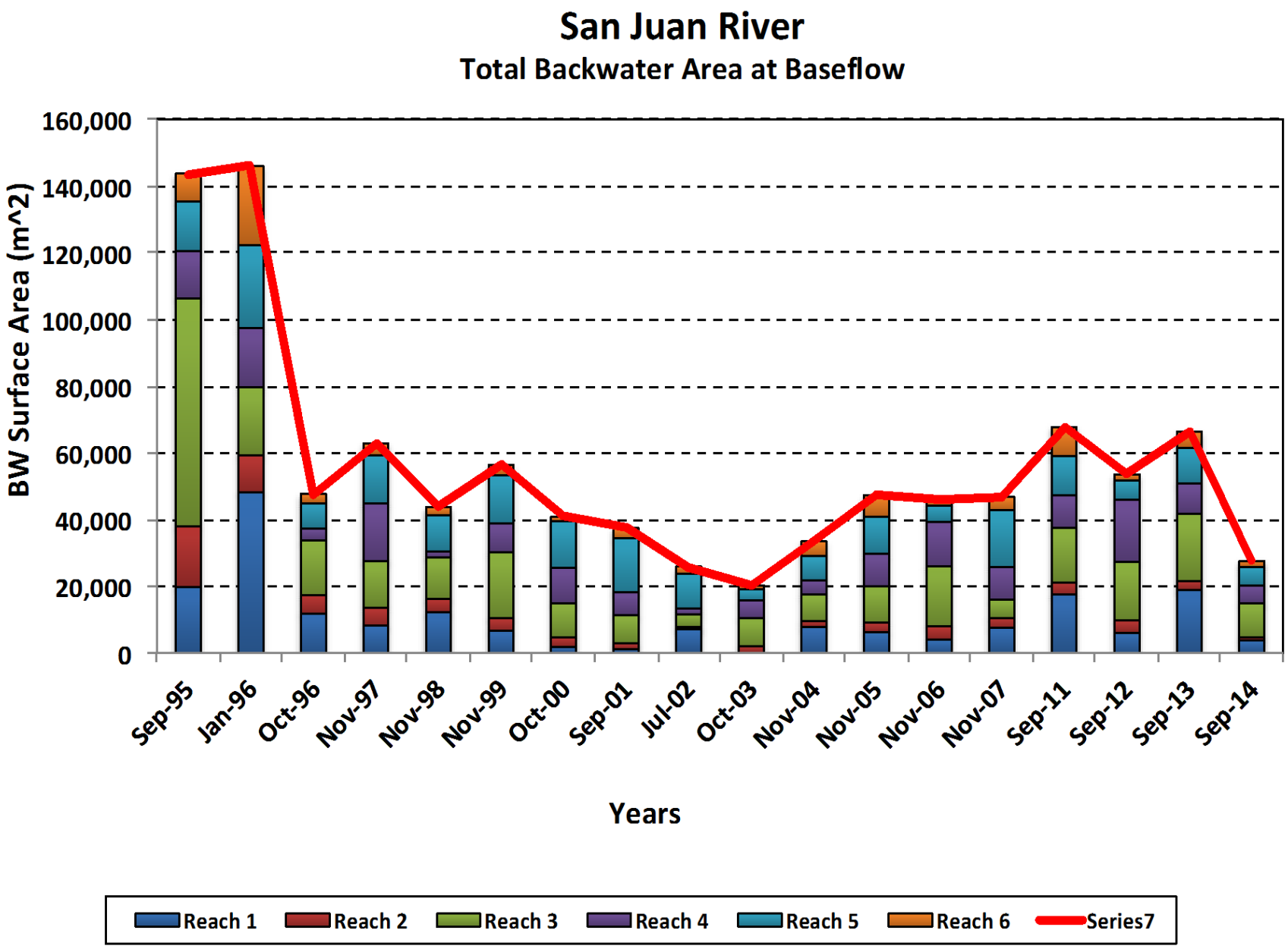
Backwater and Embayment Distributions

Backwater Habitat Type Comparison



Non-Canyon Reach Backwaters

4,000 m^2 Lost in RM 105


San Juan River
Total Backwater Area at Baseflow
BW Surface Area (m^2)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Sep-95
Jan-96
Oct-96
Nov-97
Nov-98
Nov-99
Oct-00
Sep-01
Jul-02
Oct-03
Nov-04
Nov-05
Nov-06
Nov-07
Sep-11
Sep-12
Sep-13
Sep-14
Years
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Series7

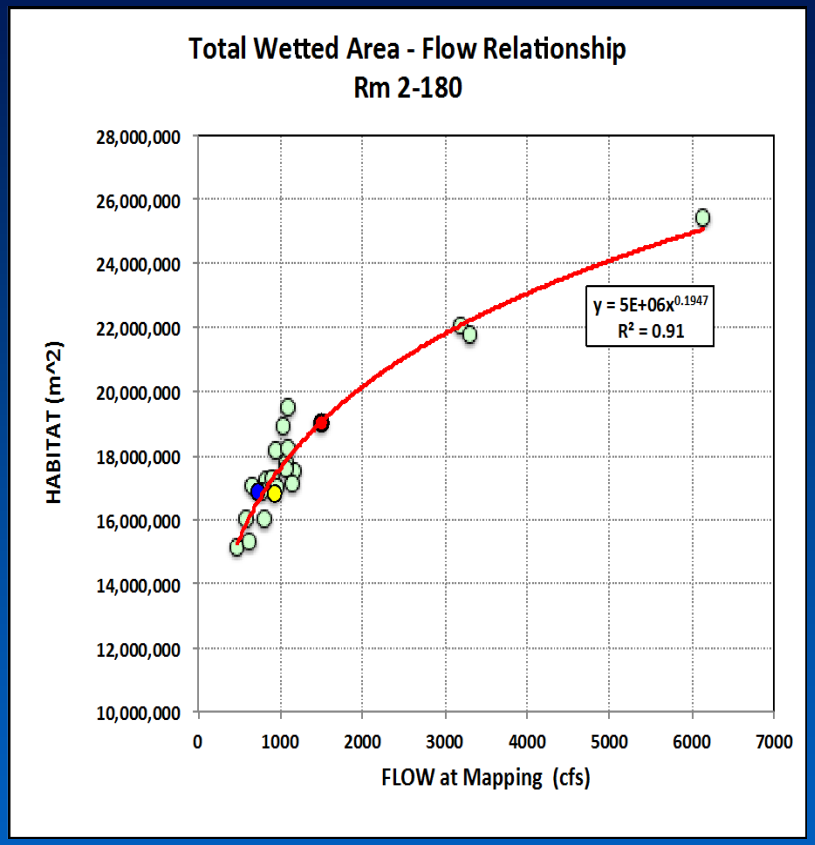
2013-2014 Observations

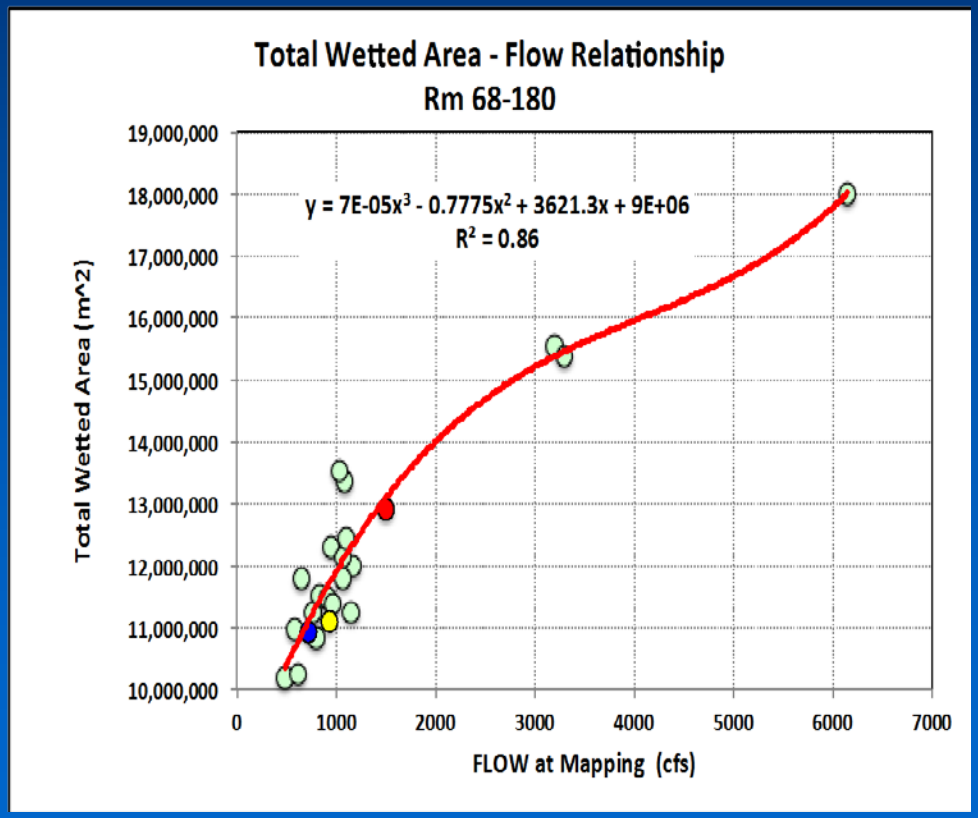
- In 2014, high base flows greater than 1500 cfs had affects on the habitats mapped in the San Juan River
- Backwater decreased from 66,342 in 2013 to 27,580 in 2014 with most of the decrease in Reach 1 and Reach 3
- Lowest BW Density since October 2003
- Flows above 2,000 cfs Drastically Reduce Backwater Area

TWA Analysis

Has the Channel Changed ?

TWA vs Mapping Flow





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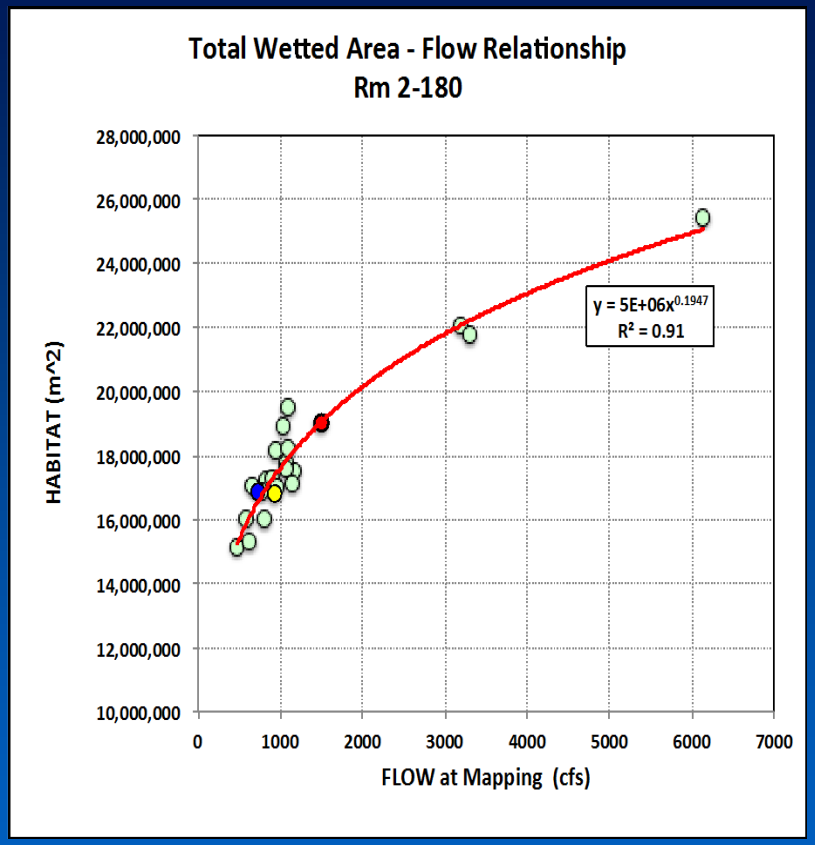
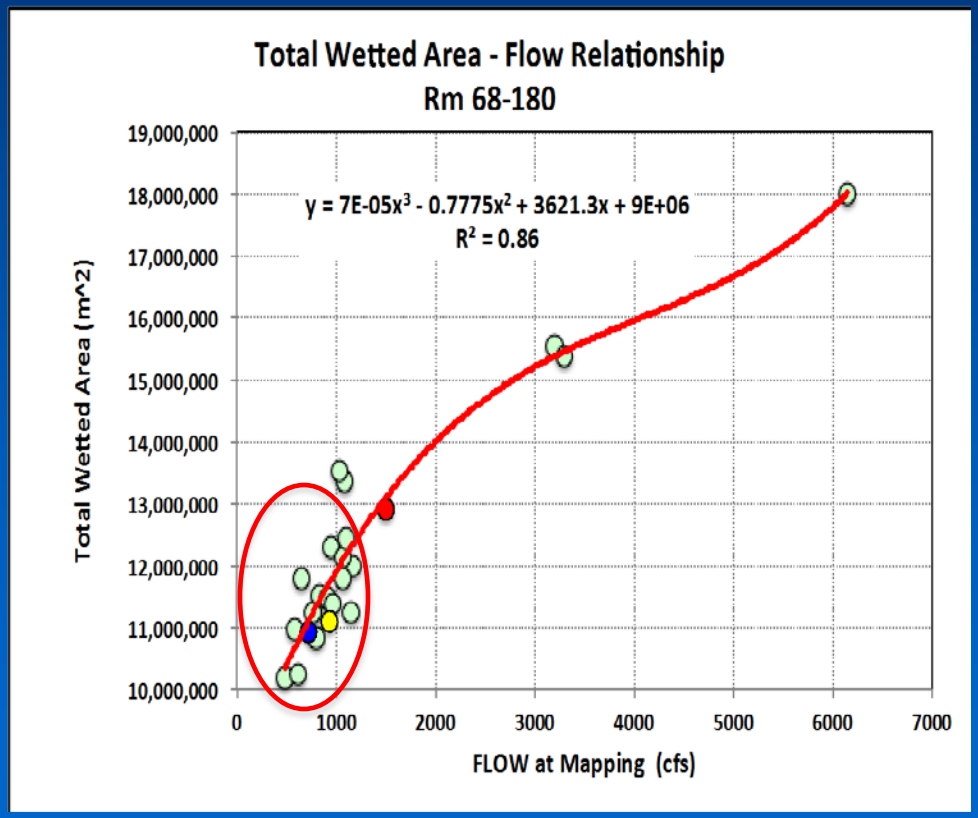
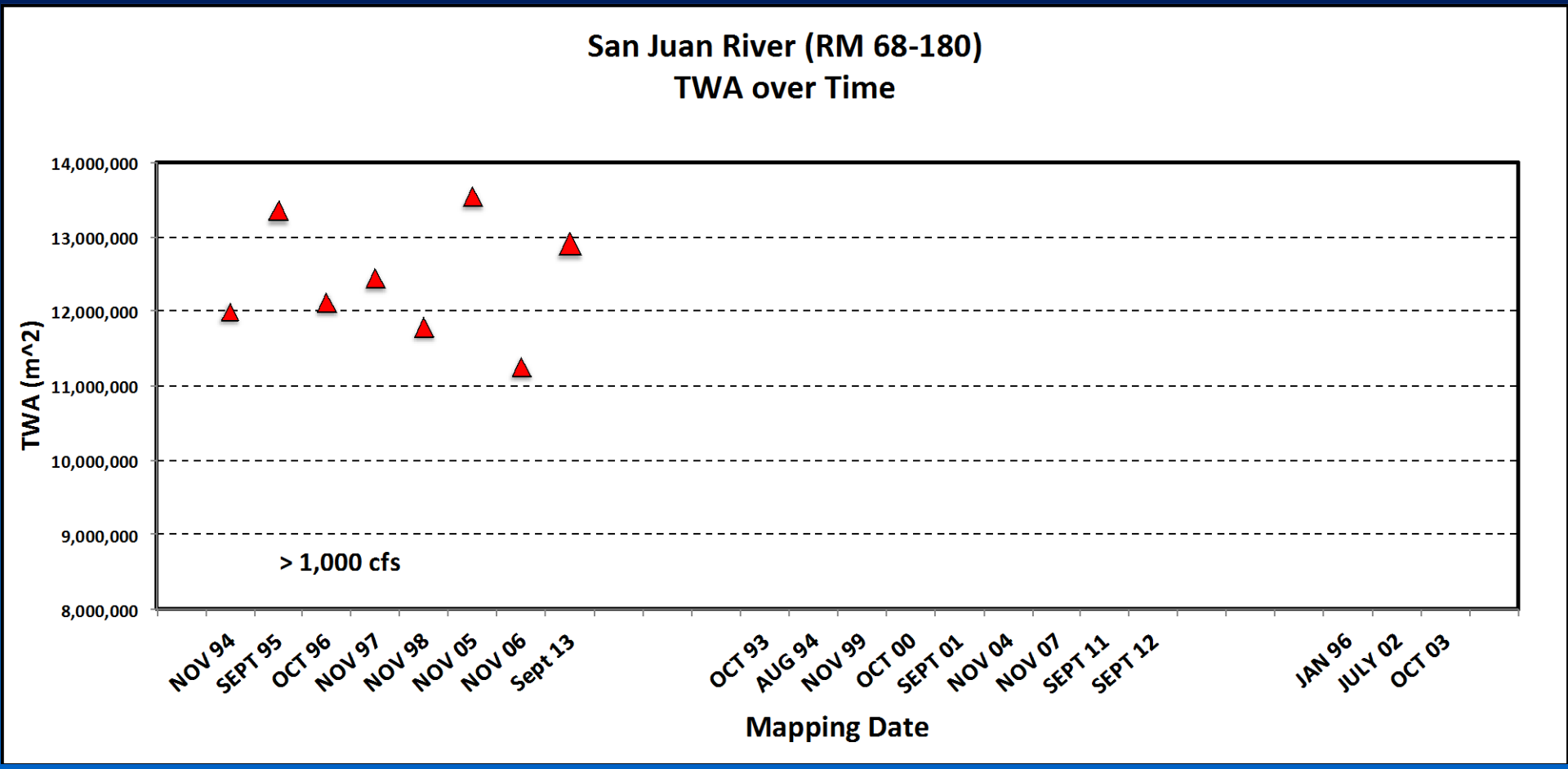
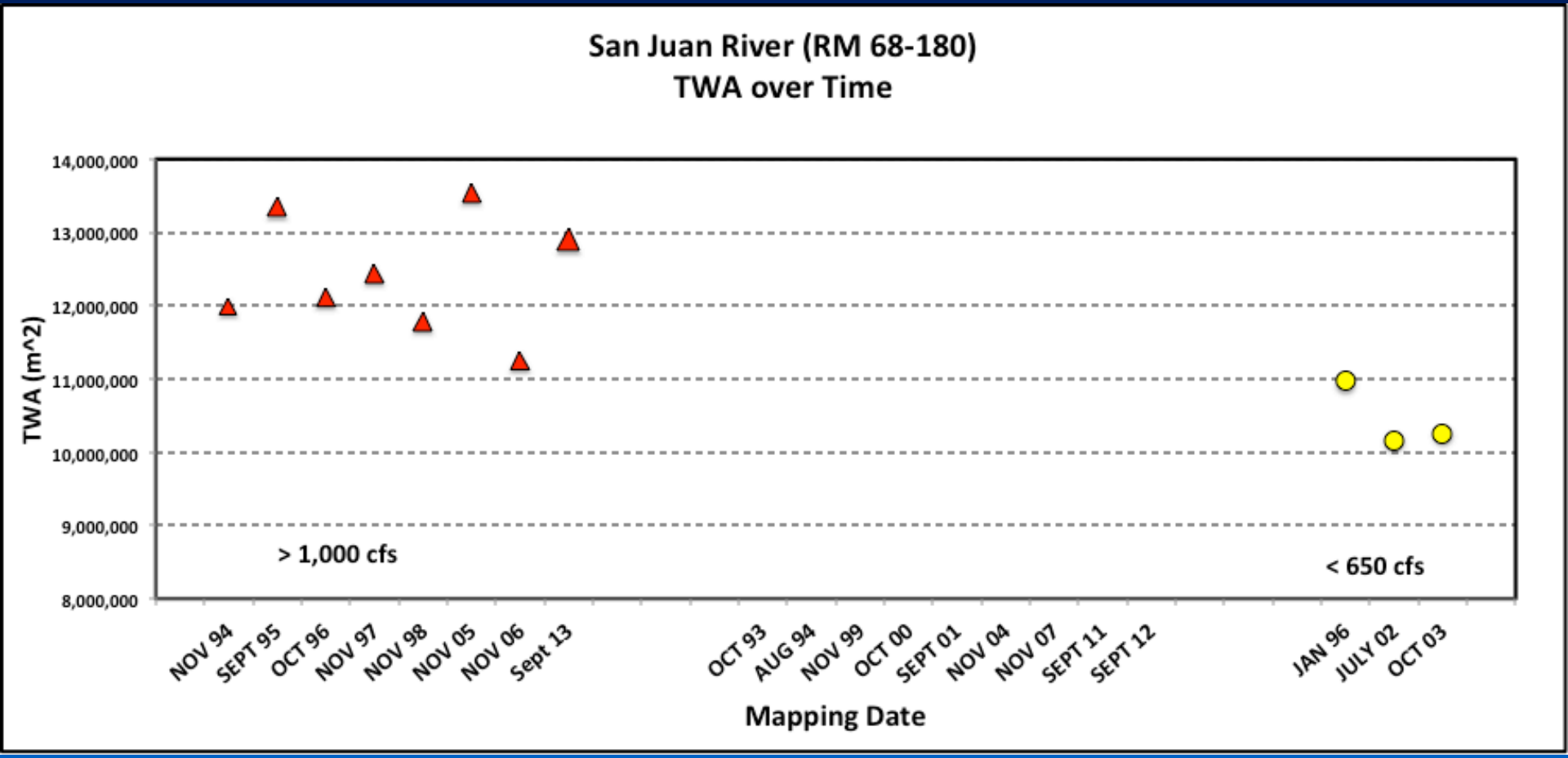




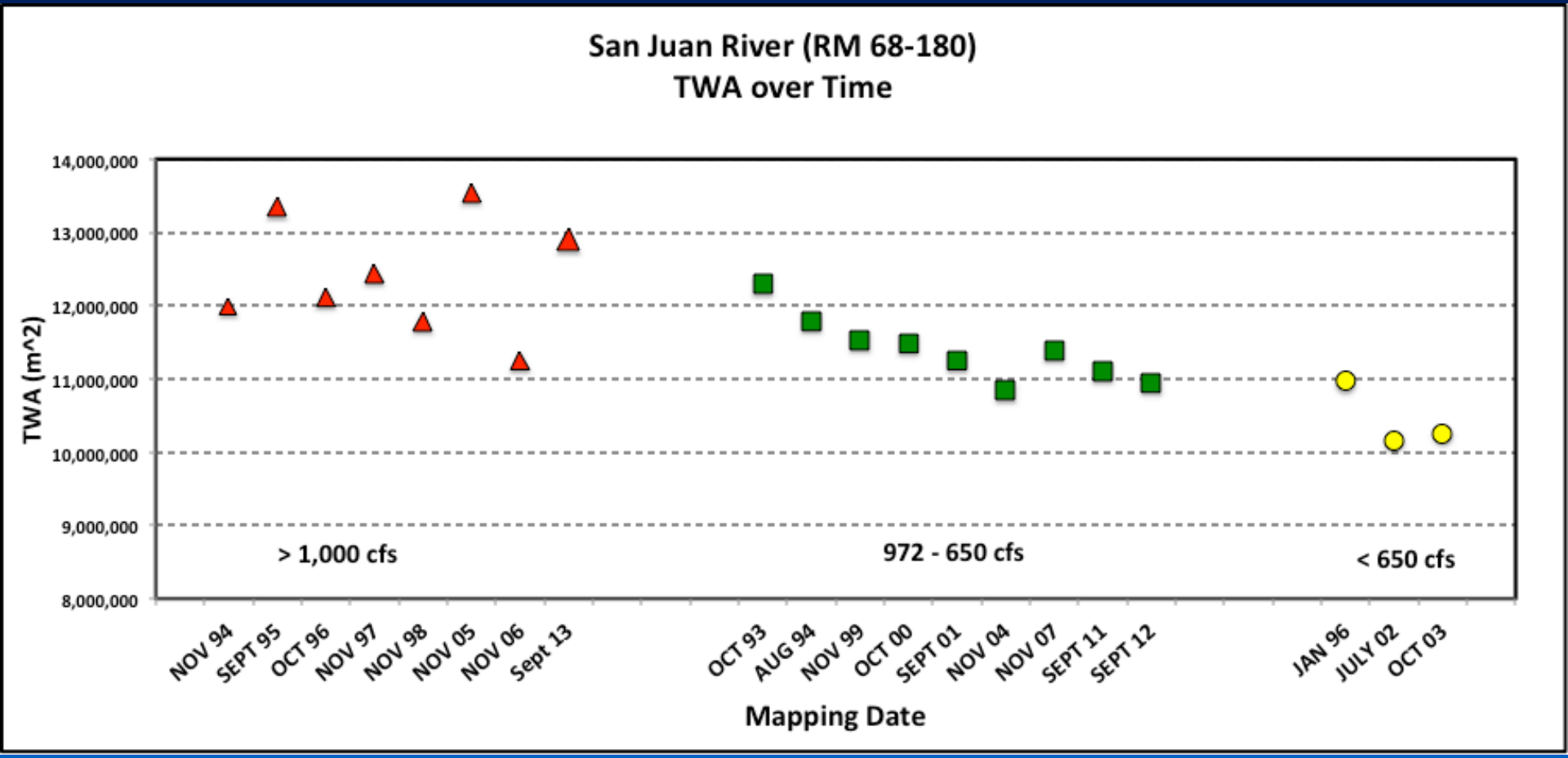
TWA @ Base Flows >1000 cfs



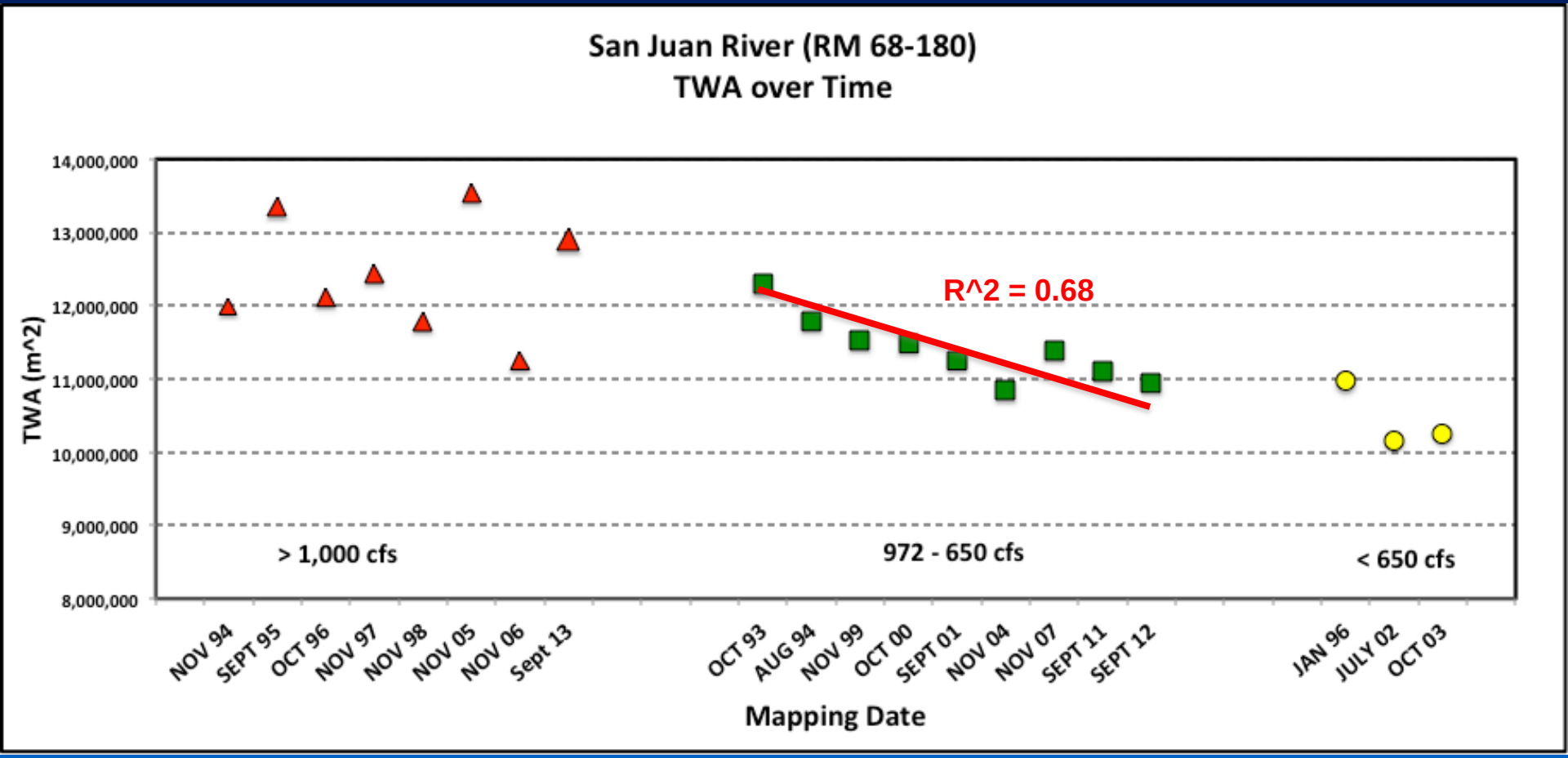
TWA @ Base Flows <650 cfs & >1000 cfs



TWA @ All Base Flows



TWA @ All Base Flows



TWA Since 1993

- Loss of 1.35 Million m^2 TWA
- 11% Loss in Habitat Area at Flows Between 972 and 650 cfs since December 1992

Where and Why has TWA Been Lost ?

Where and Why has TWA Been Lost ?

Loss of Channels in our Multiple Channel System

- **Abandonment by down cutting ?**
- **Abandonment by Deposition ?**

Channel Narrowing

Where and Why has TWA Been Lost ?

→ **Loss of Channels in our Multiple Channel System**

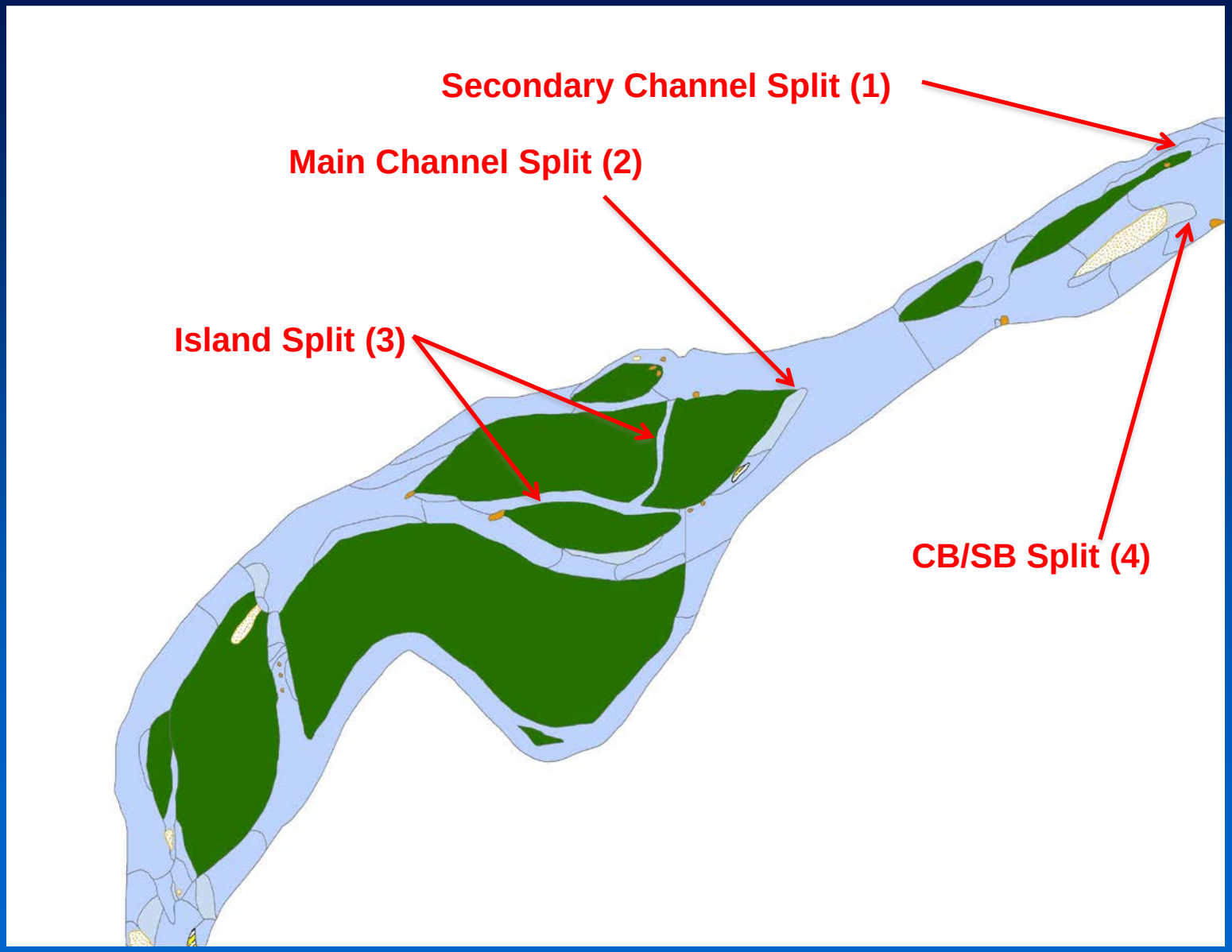
- **Abandonment by down cutting ?**
- **Abandonment by Deposition ?**

Channel Narrowing

Historical Review of Multiple Channels

- **Define Channel Types**
  - Secondary Channels
  - Main Channel Splits
  - Island Splits
  - Cobble Bar/ Sand Bar Channel Splits

Channel Types

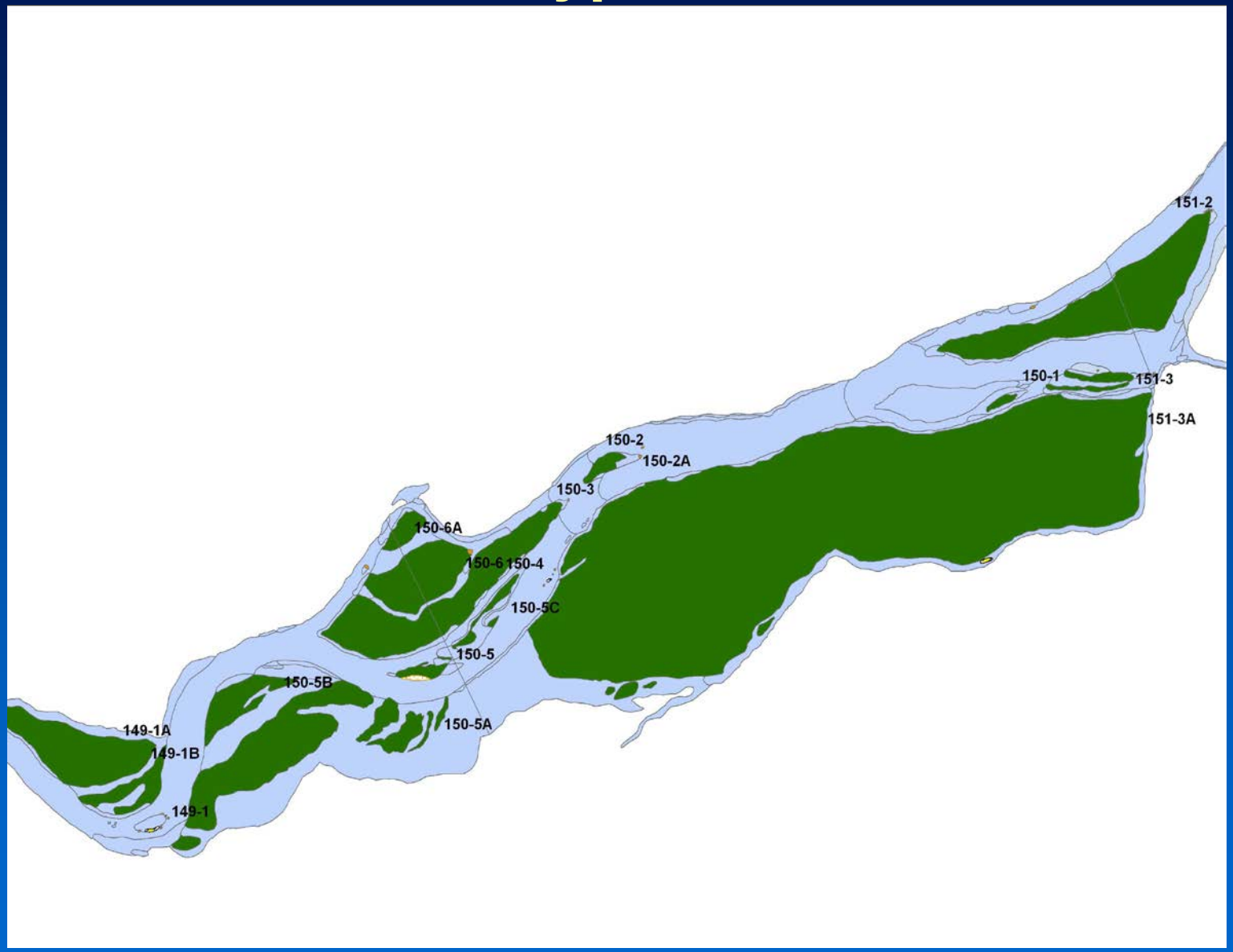


Historical Review of Multiple Channels

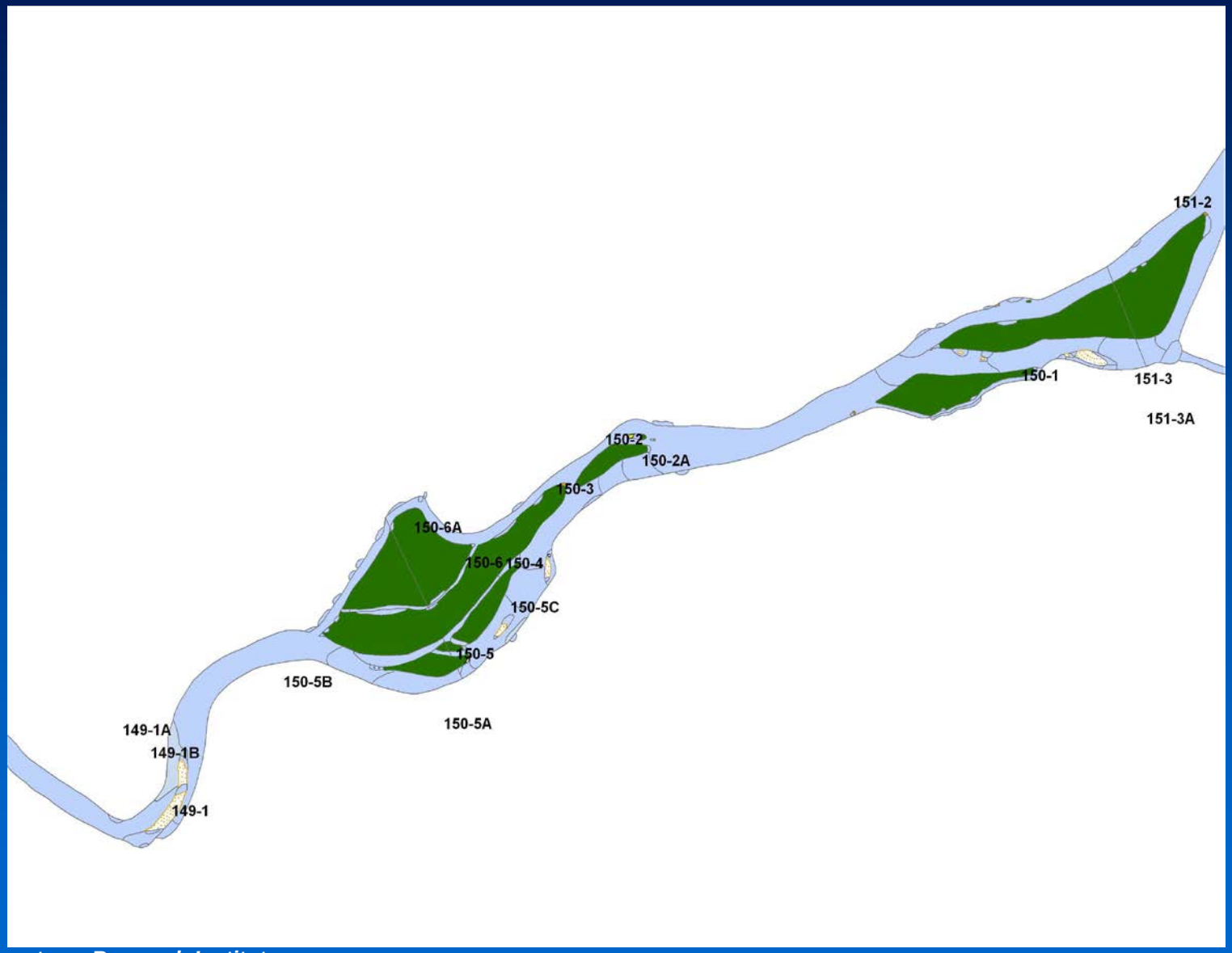
- Define Channel Types
  - Secondary Channels
  - Main Channel Splits
  - Island Splits
  - Cobble Bar/ Sand Bar Channel Splits

- Categorize Historical Mapping Data at Observed Flows
  - For each Channel Type, Assign Unique Number and Determine Binary State (IE 1 or 0)

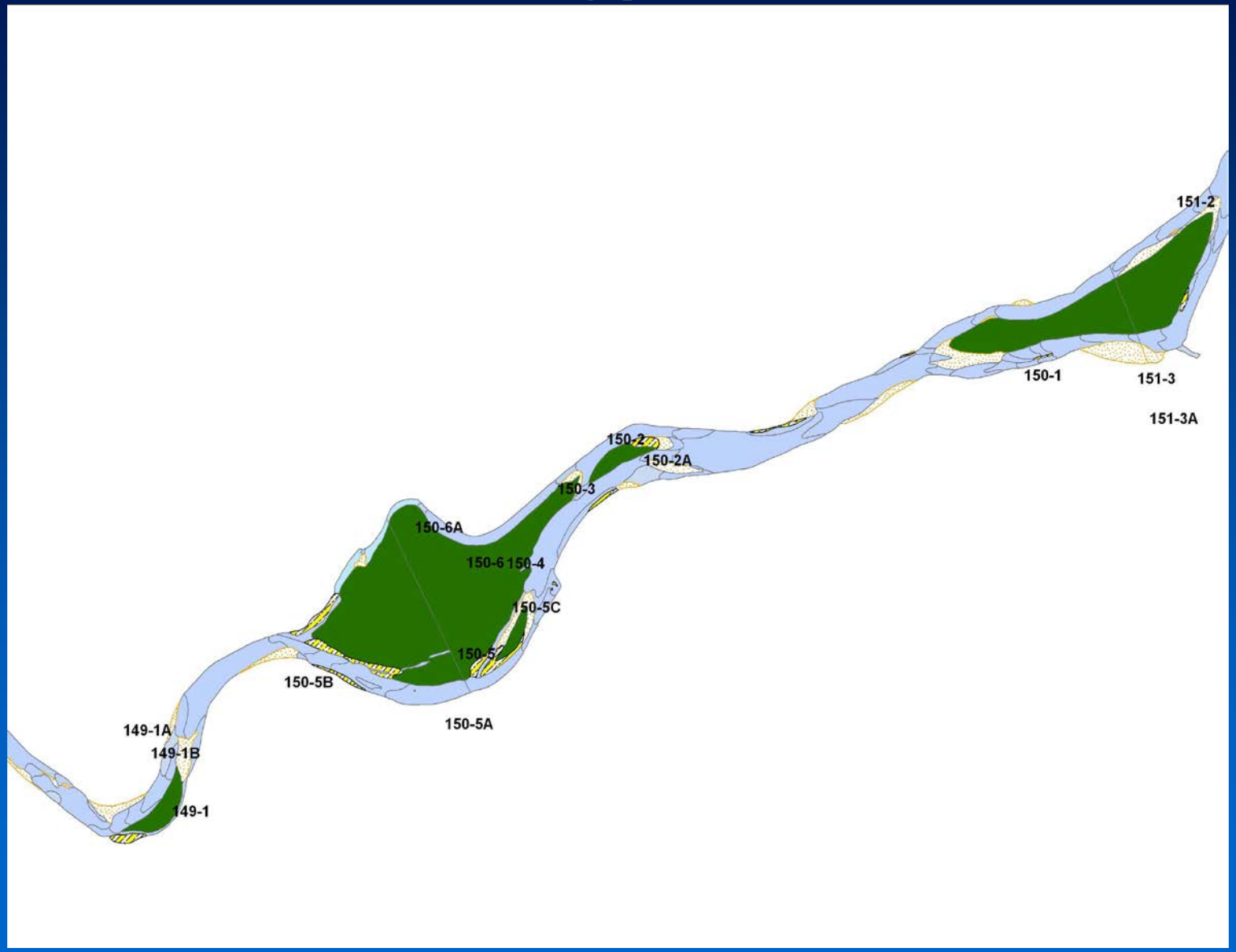
Channel Types @ 9,450 cfs



Channel Types @ 3,100 cfs



Channel Types @ 480 cfs



Channel Type Data Base Development

		Date	Dec-92	Jun-93	Jul-93	Oct-93	Jun-94	Aug-94	* * *	Sep-13		
		Days from Start	0	182	212	304	547	608		7579		
		Flow (cfs)	867	9453	1239	954	6147	659		1500		
River Mile Channel	Channel Type										Total	% of Total
*												
*												
*												
151-1	1		1	1	1	1	1	1	* * *	1	24	92%
151-2	2		1	1	1	1	1	1		1	26	100%
151-3	3		0	1	0	0	1	0		0	3	12%
151-3A	1		0	1	0	0	0	0		0	1	4%
150-1	3		0	1	0	0	1	0		0	5	19%
150-2	2		1	1	1	1	1	1		1	26	100%
150-2A	4		0	0	1	0	0	0		1	17	65%
150-3	3		1	1	1	1	1	1		1	23	88%
150-4	3		1	1	1	0	1	0		1	21	81%
150-5	3		0	1	0	0	1	0		0	5	19%
150-5A	1		0	1	0	0	0	0		0	1	4%
150-5B	1		0	1	0	0	0	0		0	1	4%
150-5C	3		0	0	1	1	1	1		1	24	92%
150-6	3		0	1	0	0	1	0		0	3	12%
150-6A	3		0	1	0	0	0	0		0	2	8%
149-1	4		1	1	1	1	1	1		0	18	69%
149-1A	1		0	1	0	0	0	0		0	1	4%
149-1B	3		0	1	0	0	0	0		1	2	8%
*												
*												
*												
All 68-180			213	406	264	323	418	304	* * *	288		

Historical Review of Multiple Channels

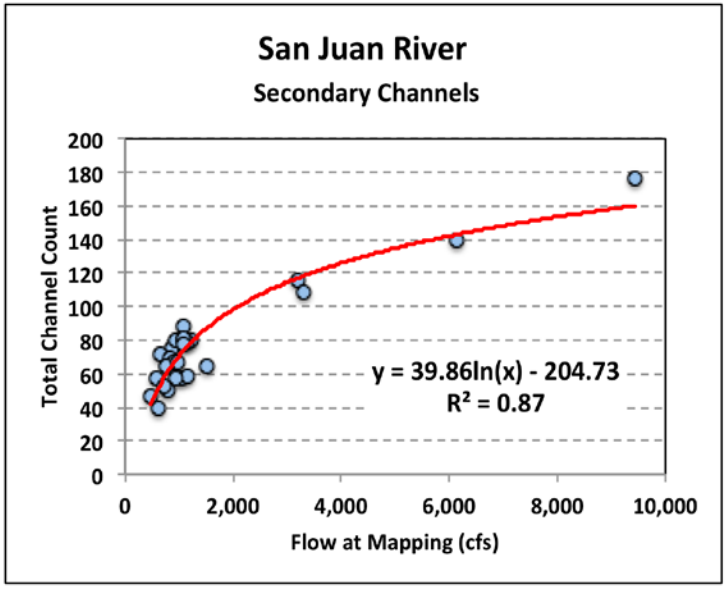
- Define Channel Types
  - Secondary Channels
  - Main Channel Splits
  - Island Splits
  - Cobble Bar/ Sand Bar Channel Splits
- Use Historical Mapping at Observed Flows
  - By Location and Channel Type, Assign Unique Number and Determine Binary State (IE 1 or 0)
- Initial Data Analysis
  - Time Effects on the Change in River wide Channel Type Densities
  - Complicated by Flow affects
  - Possible factors affecting the observed TWA Reduction
  - Future Analysis for integration

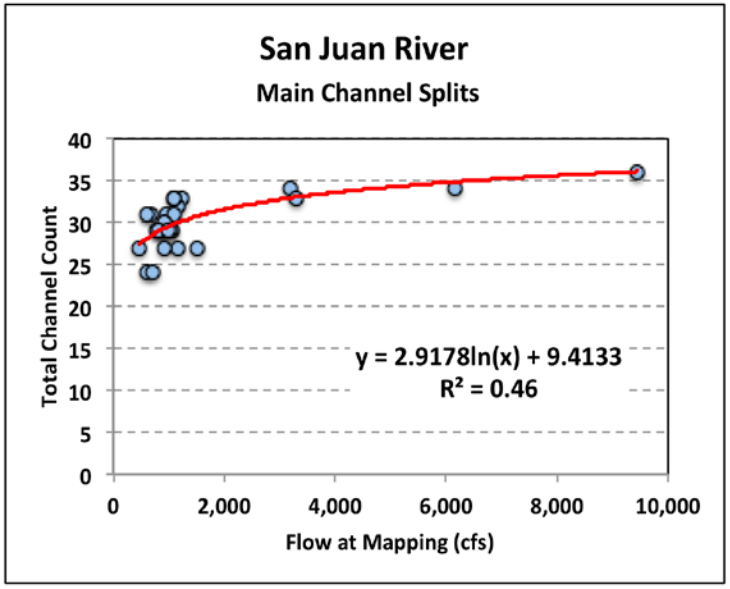
Channel Type Distributions

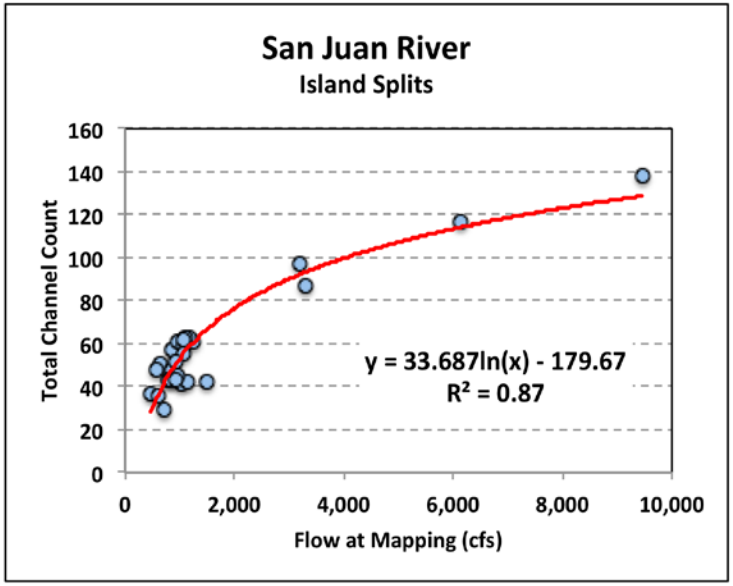
- 670 Total Channels Defined in 26 Mapping Events
  - Secondary Channel Splits 228 (34%)
  - Main Channel Splits 69 (10%)
  - Island Splits 204 (31%)
  - Cobble/Sand Bar Splits 169 (25%)

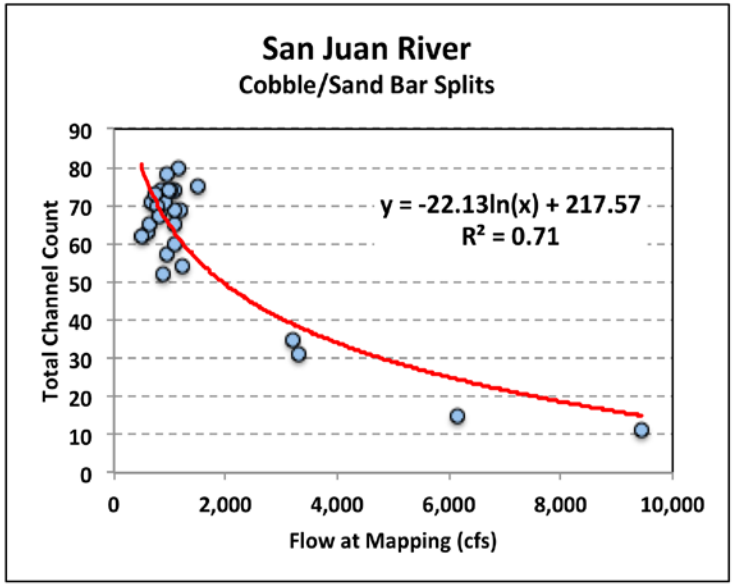
- Mapping Events Had Flows Ranging from 479 to 9,453 cfs
- Mapping From December 1992 to September 2013

Flow - Channel Density Relationship









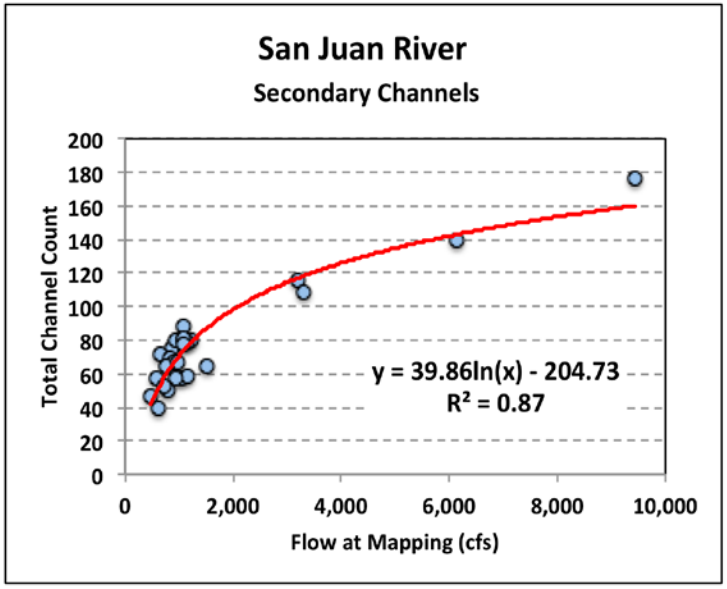
Channel Type Multiple Linear Regression

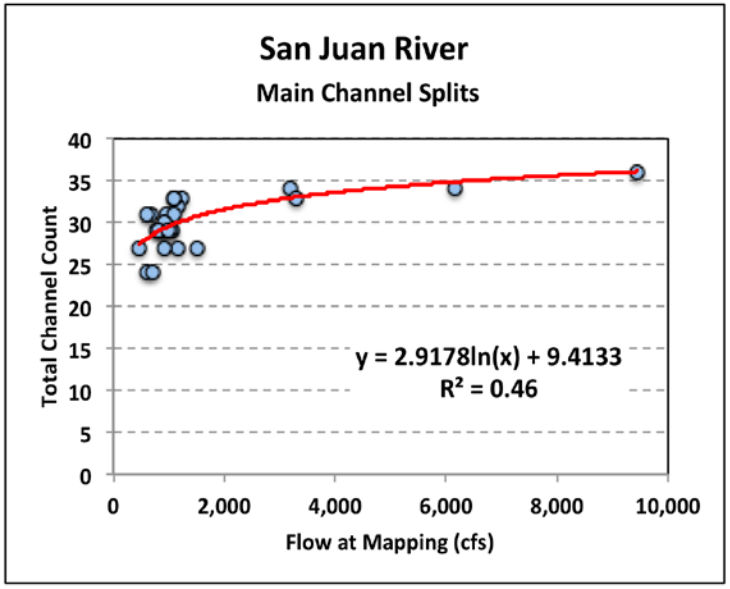
Equation: Y = a(X) +b(Z) +c

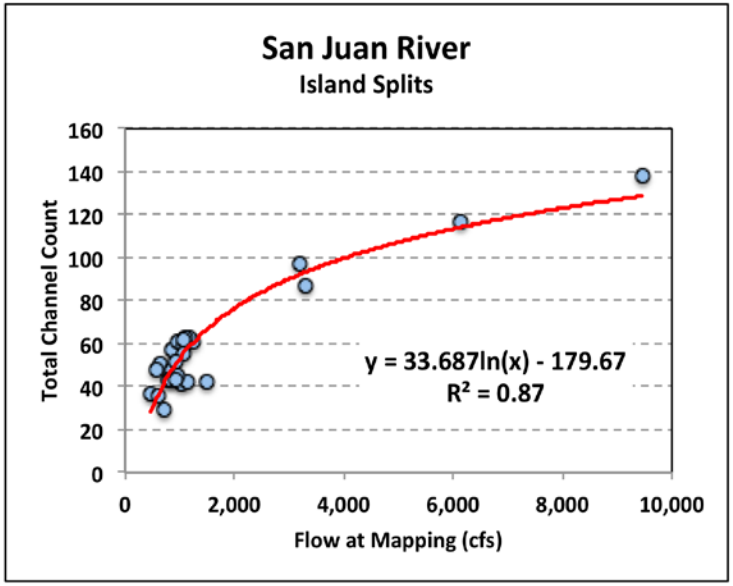
Dependent Variable

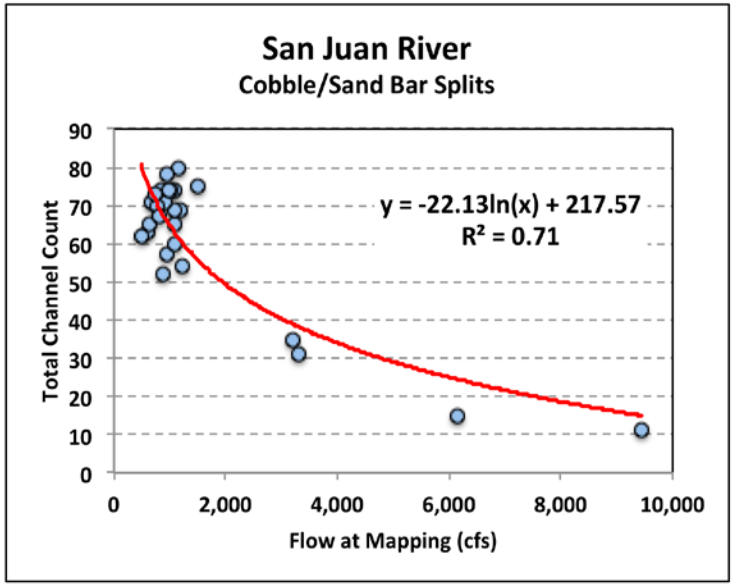
							R Squared	d.f.=25
Secondary Channels	=	+	0.0120*(Flow)	-	0.0038*(Days)	+ 66.7	0.93	
Main Channel Split	=	+	0.0006*(Flow)	-	0.0008*(Days)	+ 31.2	0.75	
Island Split	=	+	0.0103*(Flow)	-	0.0036*(Days)	+ 51.2	0.95	
Cobble/Sand Bar Split	=	-	0.0070*(Flow)	+	0.0026*(Days)	+ 65.5	0.85	

Flow - Channel Density Relationship









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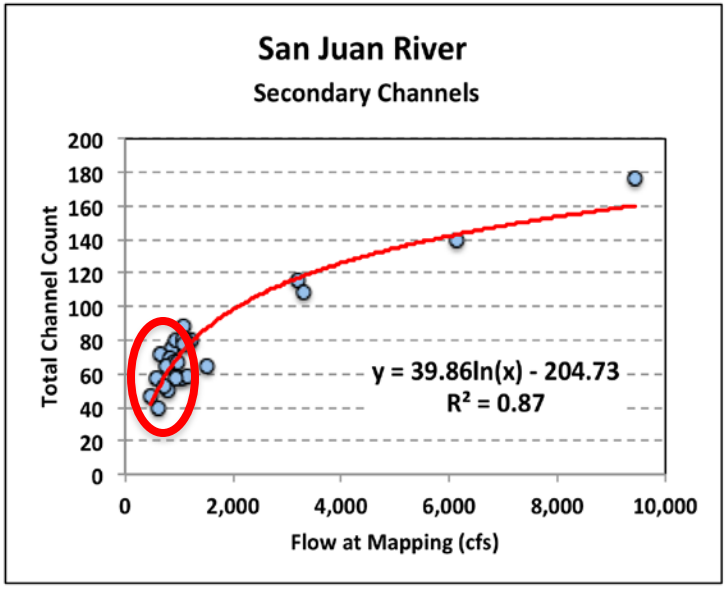
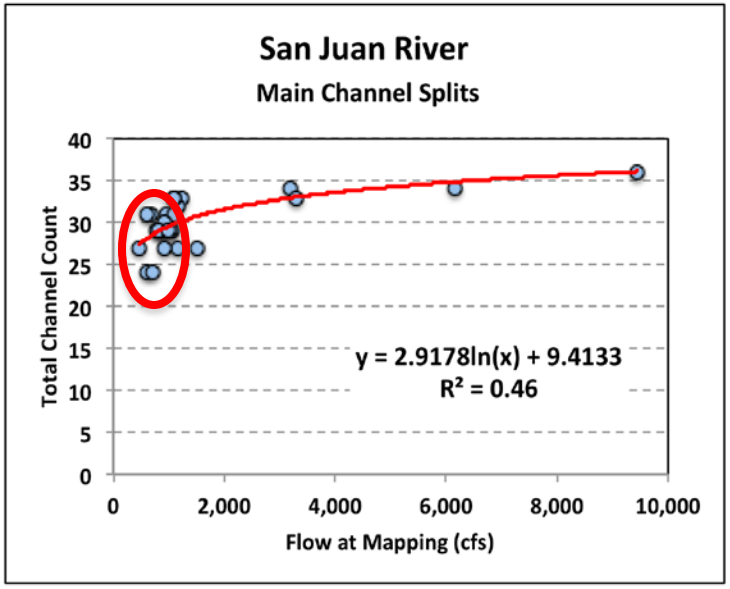
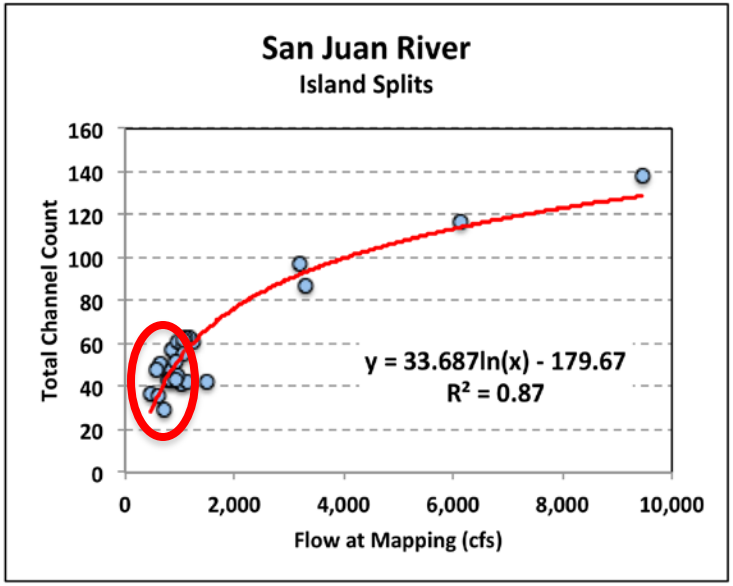
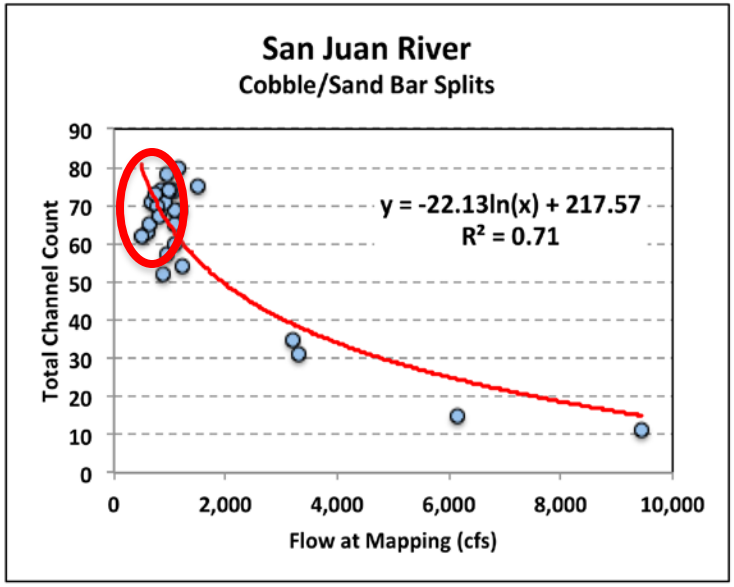
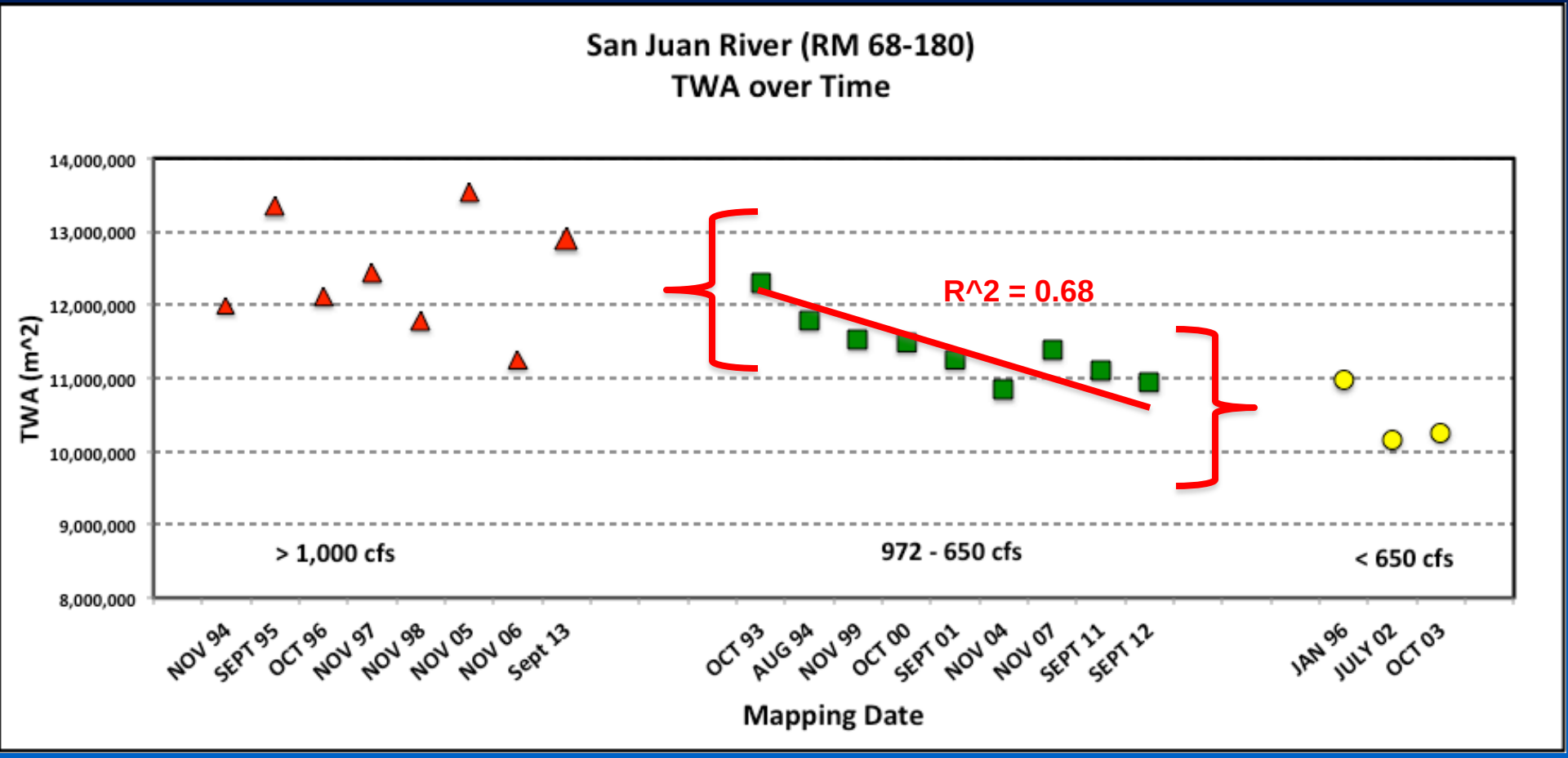




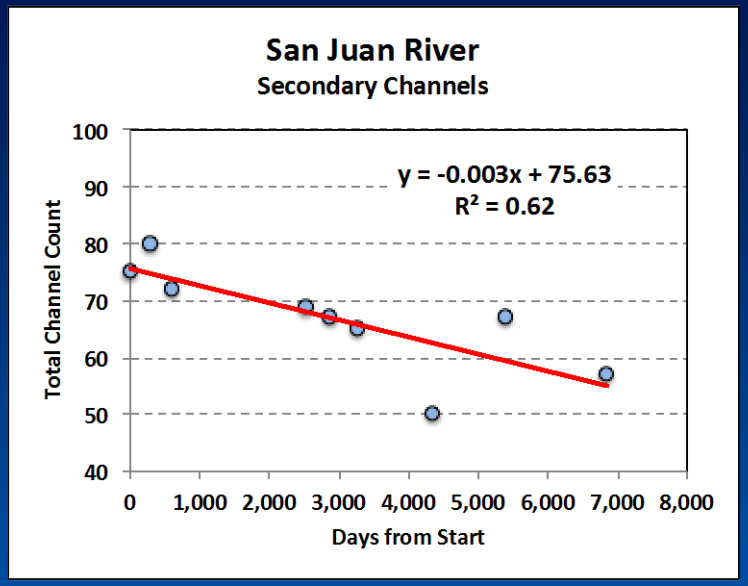


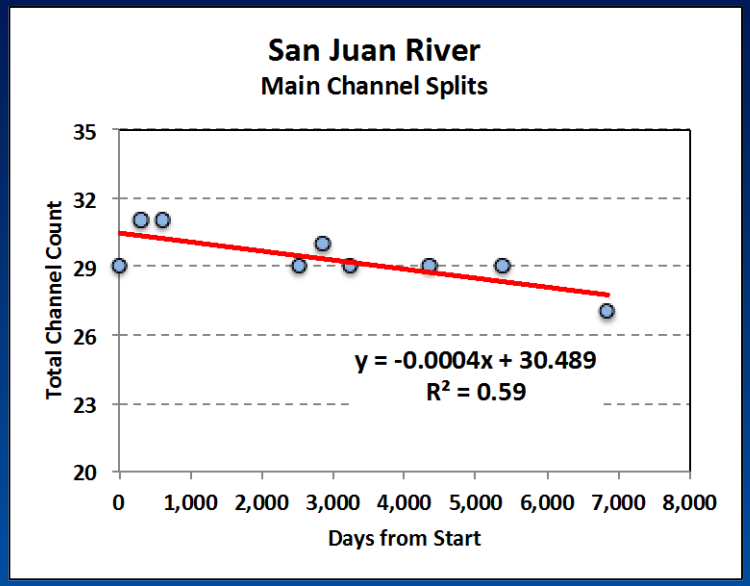


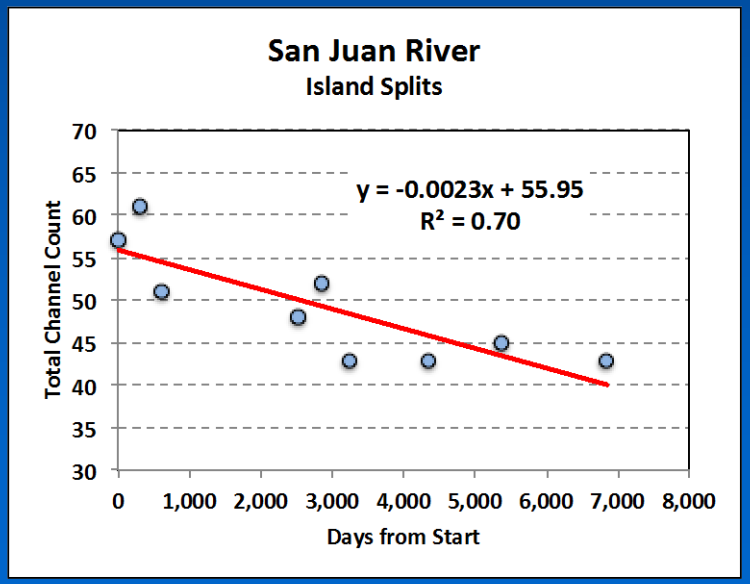
TWA @ All Base Flows

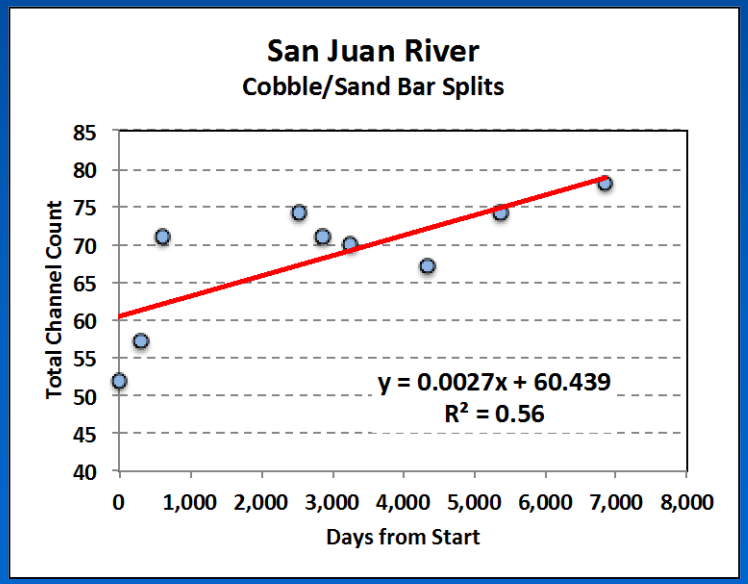


What is the Relationship between Channel Type Density and Time at Flows Between 972-650 cfs









Using TWA as the Dependent Variable, use step-wise multiple Regression

Use Step-Wise Multiple Regression

- TWA as the Dependent Variable
- Flow, Time and Channel Types as Independent Variables

TWA Multiple Linear Regression RM 68-180

Equation: Y = a(X) +b(Z) +c

Dependent Variable					R Squared	d.f.
TWA (All Flows)	=	+ 57,580*(SC)	+ 7.260M		0.86	21
TWA (<1,500 cfs)	=	+ 46,195*(SC)	- 1,714*(Flow)	+ 9.67M	0.57	19
TWA (<1,000 cfs)	=	+ 44,386*(SC)	+ 7.98M		0.94	11
TWA (>650 & <1,000)	=	+ 37,732*(SC)	- 18,321*(CB/SB)	+ 10.43M	0.98	8

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Future Integration with Fisheries Data

Antecedent Parameters

Days <500 cfs
Days >500 & <1000 cfs
Days <750 cfs
Days >750 <1000 cfs
Days >1000 <1500 cfs
Days >1500 <2000 cfs
Days >2000 <2500 cfs
Days >2500 cfs
Days >5000 cfs
Days >=8000 cfs
Days >=10000 cfs
Max Flow cfs
Min Flow cfs
Total Ann RO (Ac Ft)
Total SPR RO (Ac Ft)
Assending RO (Mar 1-May 31) (Ac Ft)
Decending RO (June 1-July 31) (Ac Ft)

Habitat Parameters

Days	SLW Type
Flow	SHOL TYPE
Sec Channel	VEG TYPE
Main Channel Split	ISL Count
Island Split	ISL Area
(CB/SB) Split	ISL Perimeter
All Dhannels	TWA
BW Type	LVH Type
RUN Type	COBBLE Type
RIFFLE Type	SAND Type
MIXED Type	

TWA ANALYSIS CONCLUSIONS

- TWA has shown a significant decline in TWA since 1992
- Loss of 1.35 Million m^2 of TWA
- Apparent decline has been caused by a decrease in Secondary Channels and an Increase in Cobble/Sand Bar channel splits
- Re-analysis of Channel Type Densities has led to a new avenue of Analysis of Habitat Data and Antecedent Conditions

Acknowledgements

- San Juan RIP
- Navajo Nation
- Bureau of Rec
- Bureau of Indian Affairs
- Ernie Teller