Galena Groundwater District

South Valley Groundwater District

Presentation to the Advisory Committee

Big Wood Ground Water Management Area

South Valley and Galena Groundwater Districts

- Over the last several years, the Districts have undertaken investments in measuring, developing and analyzing water metrics that provide defendable data as a basis for the implementation of a ground water management plan.
- The Districts' collaborative effort in drafting a plan has included extensive research and guidance from our respective technical consultants to create a plan that manages the aquifer in the Big Wood River Management Area.
- **Presentation Purpose:**
  - Provide SVGWD & GGWD's Perspective and Understanding. Present Relevant Information to Advisory Group
  - Discuss Concepts of Hydrology, Consumptive Use and Impact

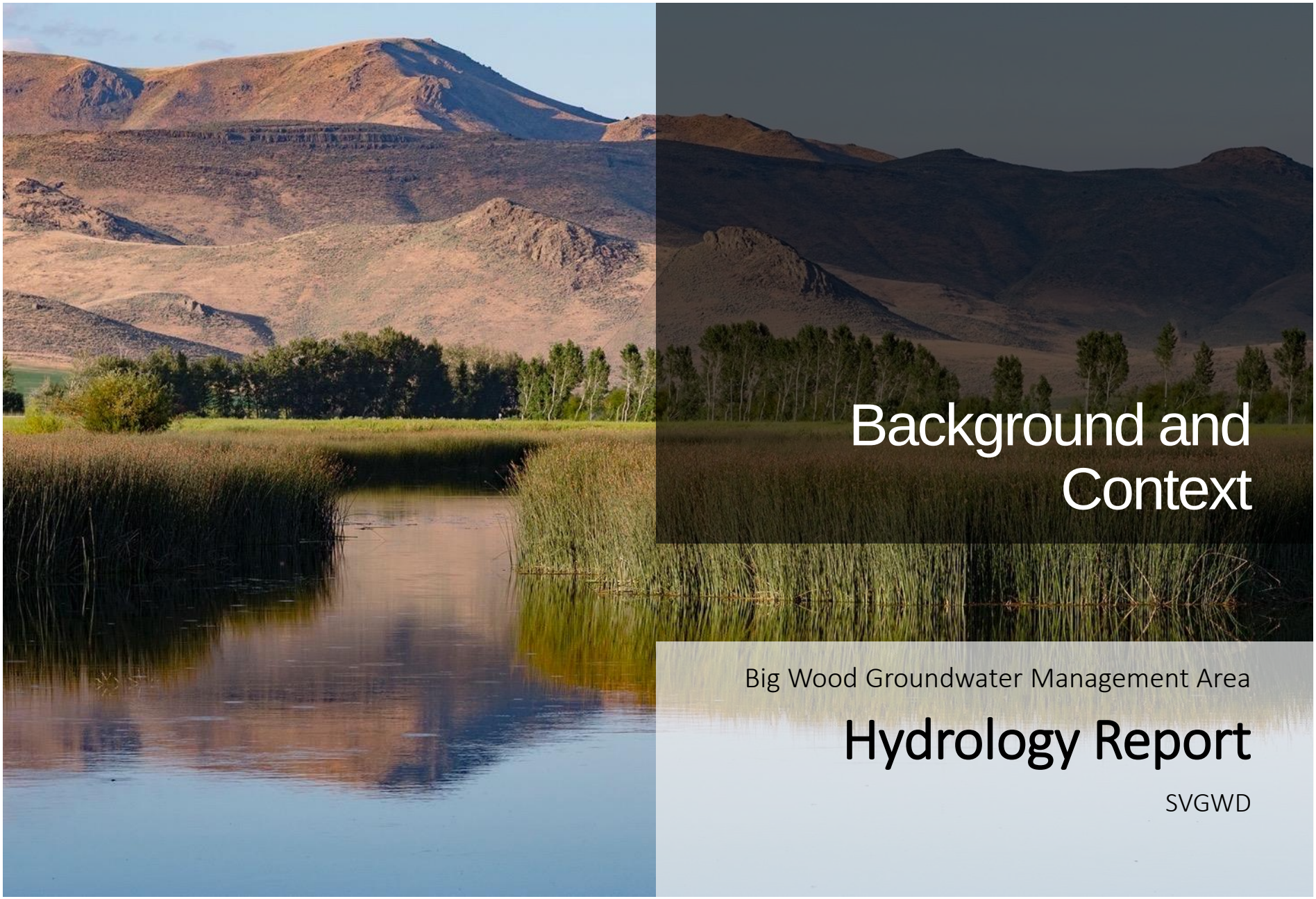
Technical Consultants

Dave Shaw	ERO Resources Corporation
Erick Powell	Brockway Engineering
Zach Hill	Ecosystem Sciences

Presentation & Topics

- **Introduction and Purpose**
- **Background Information and Context**
  - Hydrology Report
    - Water Availability and Water Delivery
    - Change in Conditions – 1970's to present
    - Provides Base Understanding for District Use and Education
- **Technical Presentation**
  - **Big Wood Basin Hydrology** – Presented by Dave Shaw
  - **Water Consumption and Statistical Analyses** - Presented by Erick Powell
  - **Comments Regarding Numbers Presented on behalf of the Surface Water Users** Presented by Dave Shaw
- **Conclusions and Summary**
- **Questions**

- **Technical Presentation**
  - **Big Wood Basin Hydrology** – Presented by Dave Shaw
    - Big Wood River / Mann-Kendall analysis
    - Magic Reservoir Storage
    - Trend Analysis Difference 1960-2020
    - Silver Creek / Mann-Kendall analysis
    - Irrigation Diversion and Deliveries
    - Groundwater Level at Long-term Well
    - Silver Creek vs Little Wood River
  - **Water Consumption and Statistical Analyses** - Presented by Erick Powell
    - Impact vs Injury
    - Ground Water Development
    - Priority Cuts
    - Water Use efficiency
    - Magic Reservoir Releases
    - Model Recharge / Mann-Kendall
  - **Comments Regarding Numbers Presented on behalf of the Surface Water Users** – Presented by Dave Shaw



Background and Context

Big Wood Groundwater Management Area

Hydrology Report

SVGWD

Hydrology Report on Wood River Valley

The purpose of this report is to provide the District members and interested parties with context and background on the current hydrology of the basin.

This context provides a look at the changes in hydrology that have occurred through time, as well as constraints and opportunities that exist to effectively manage the district water supply into the future.

The report focuses on the two major drivers of hydrology in the basin: **Water Availability and Water Delivery**.

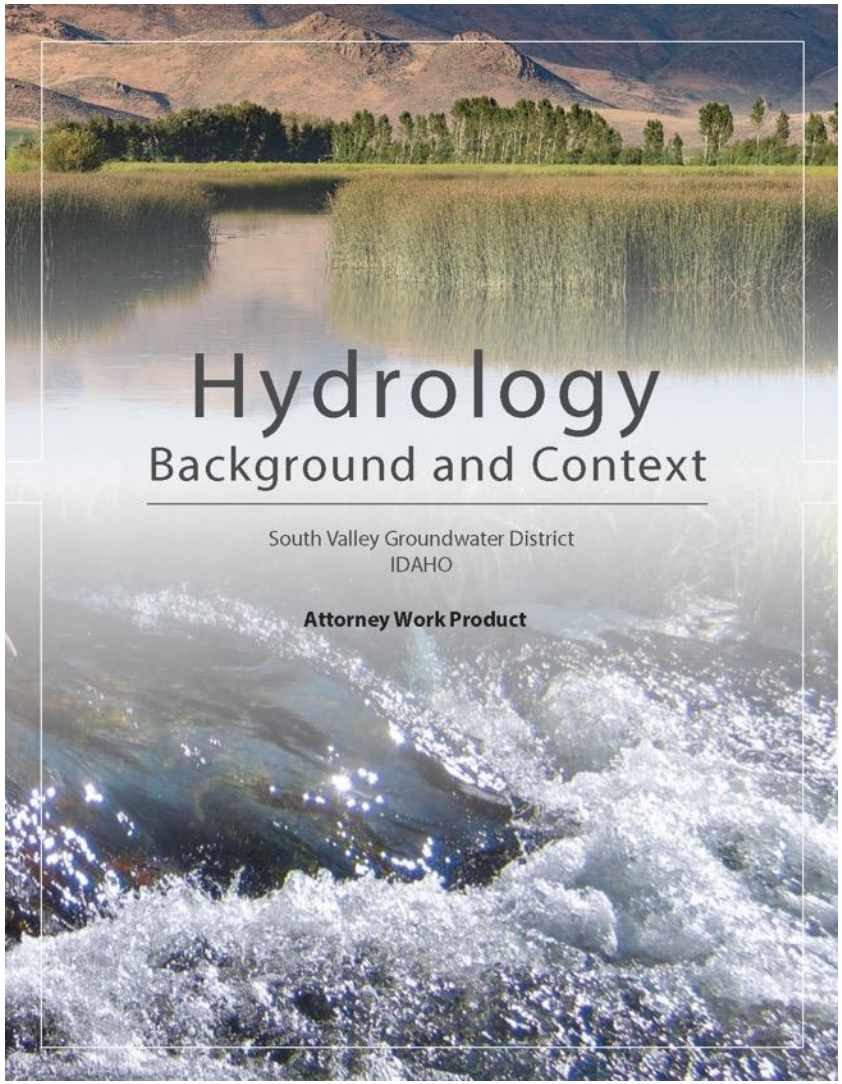
Illustrates the hydrology of the Big Wood River basin and the considerable changes in water supply conditions since the early 1970s.

Available for review from:

IDWR / Advisory Committee website.

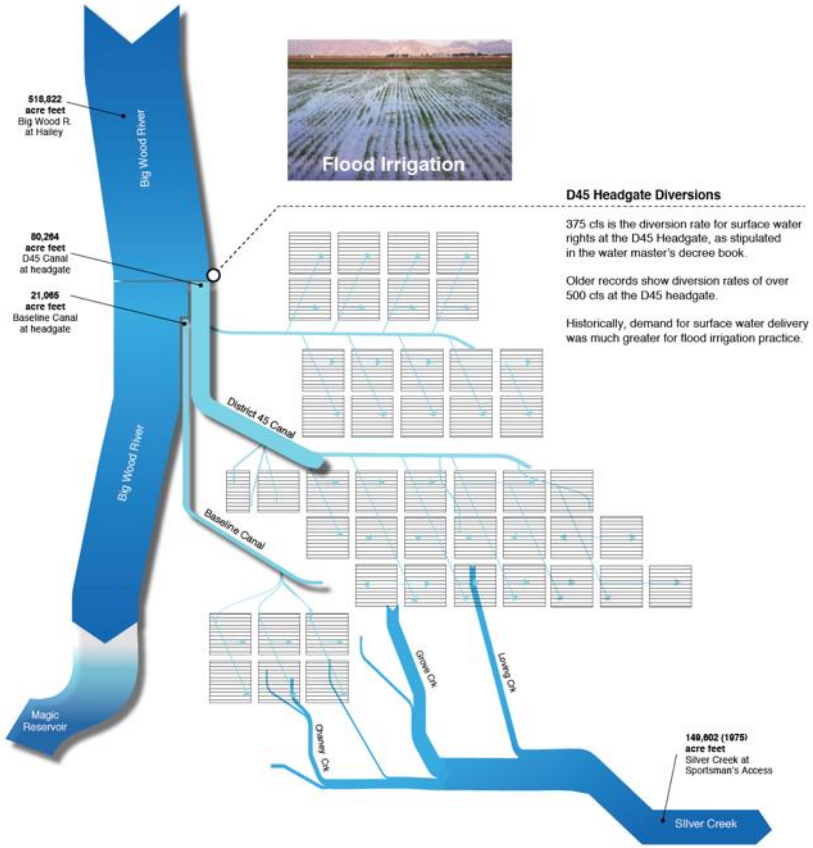
Direct download on this link:

SVGWD_HydrologyReport_021421.pdf

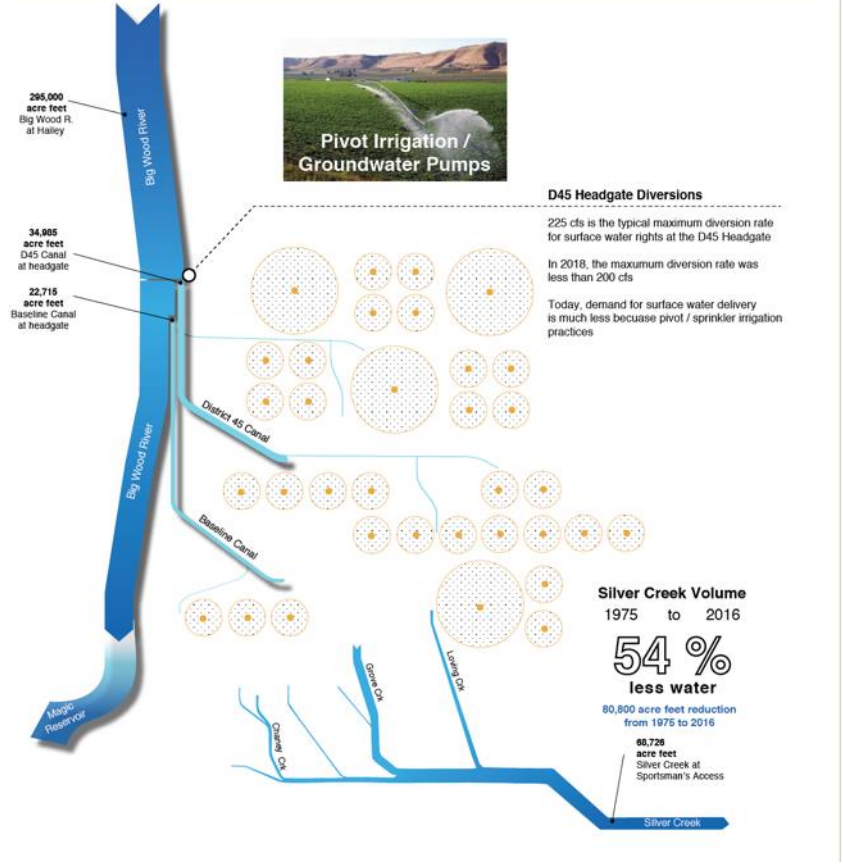


Change in Irrigation Practices 1970 - 2016

1971 Water Volumes - Flood Irrigation

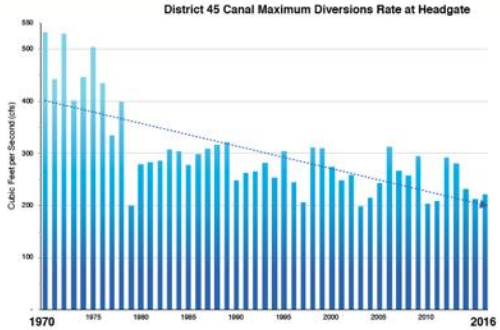


2016 Water Volumes - Pivot Irrigation



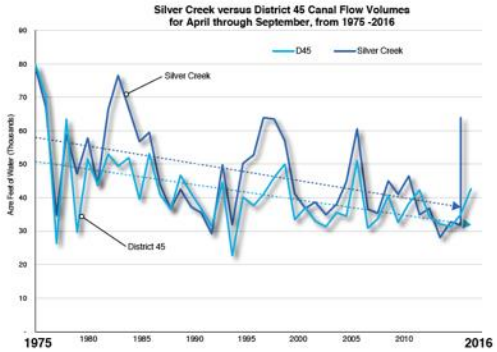
1970 - 2016

Change in Water Delivery - 1970 to 2016



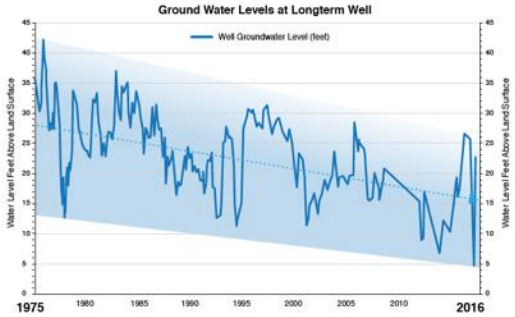
District 45 Canal Headgate Diversion

Center pivots require a constant supply of water during much of the growing season and a fixed and continuous water supply that is typically supplied by a well. Flood irrigation systems require large heads of water at intervals that allow the surface water supply to be located at a more remote location (diversion headgate and canals). The graph on the left shows the dramatic reduction in the maximum diversion rate at the D45 Canal headgate over time. The increase in pivot irrigation methods and development of wells reduced the demand for surface water deliveries. The maximum diversion rate at the D45 headgate has decreased by over 200 cfs between 1970 and 2018.



District 45 vs. Silver Creek Flows

Annual water diversions (volume in acre feet) into the District 45 canal has reduced significantly due to reduced water delivery demands. Operations in the Bellevue Triangle have required less water delivery due to increased use of pivot irrigation and well development. The reduction in annual water volume diverted at the D45 headgate matches the reduced stream flow volumes in Silver Creek over the same time period. These two systems have a mutual relationship or connection. Silver Creek flow volumes depend on surface water deliveries into the Triangle. Reduced surface water deliveries and changes in irrigation practices led to reduced incidental recharge into the groundwater and reduced stream flow volumes in Silver Creek.



Groundwater Levels

Groundwater levels have been measured for a long period of time (1954 to 2018) at a select well in the District. The graph to the left shows the decrease in groundwater level through time at this well and matches with reduced surface water deliveries, increased groundwater pumping at wells, and reduced stream flow volumes in Silver Creek. The water system in the District is strongly interrelated. Surface water delivery and groundwater use are directly tied to groundwater levels and stream flow volumes in Silver Creek.

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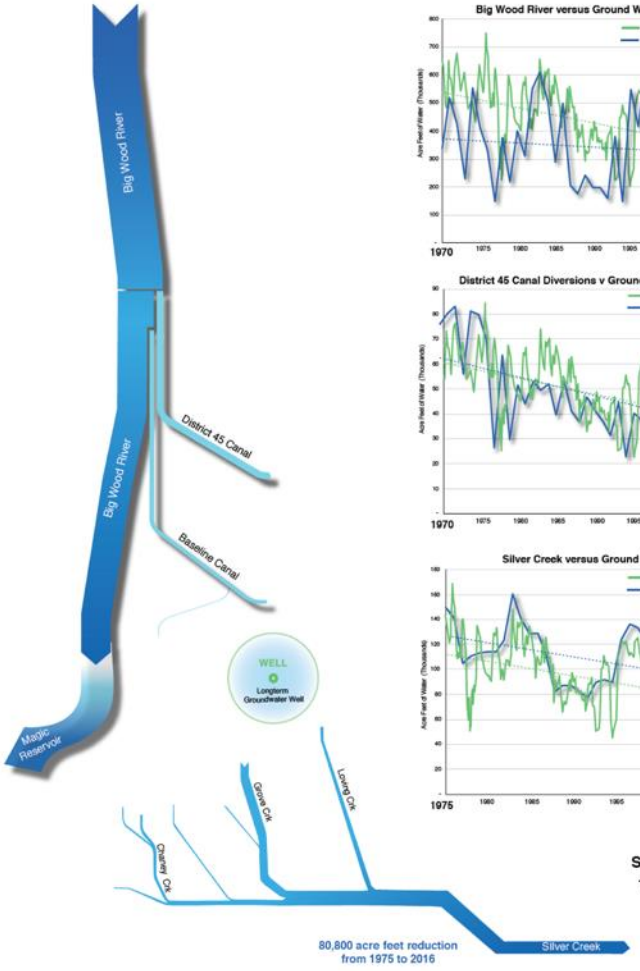
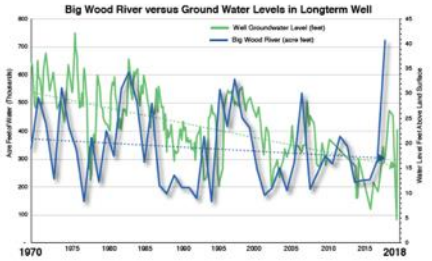
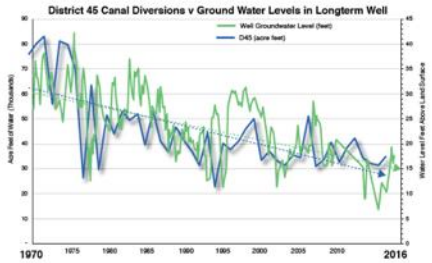
1970 - 2016

2016 Water Volumes



Change in Water Volumes





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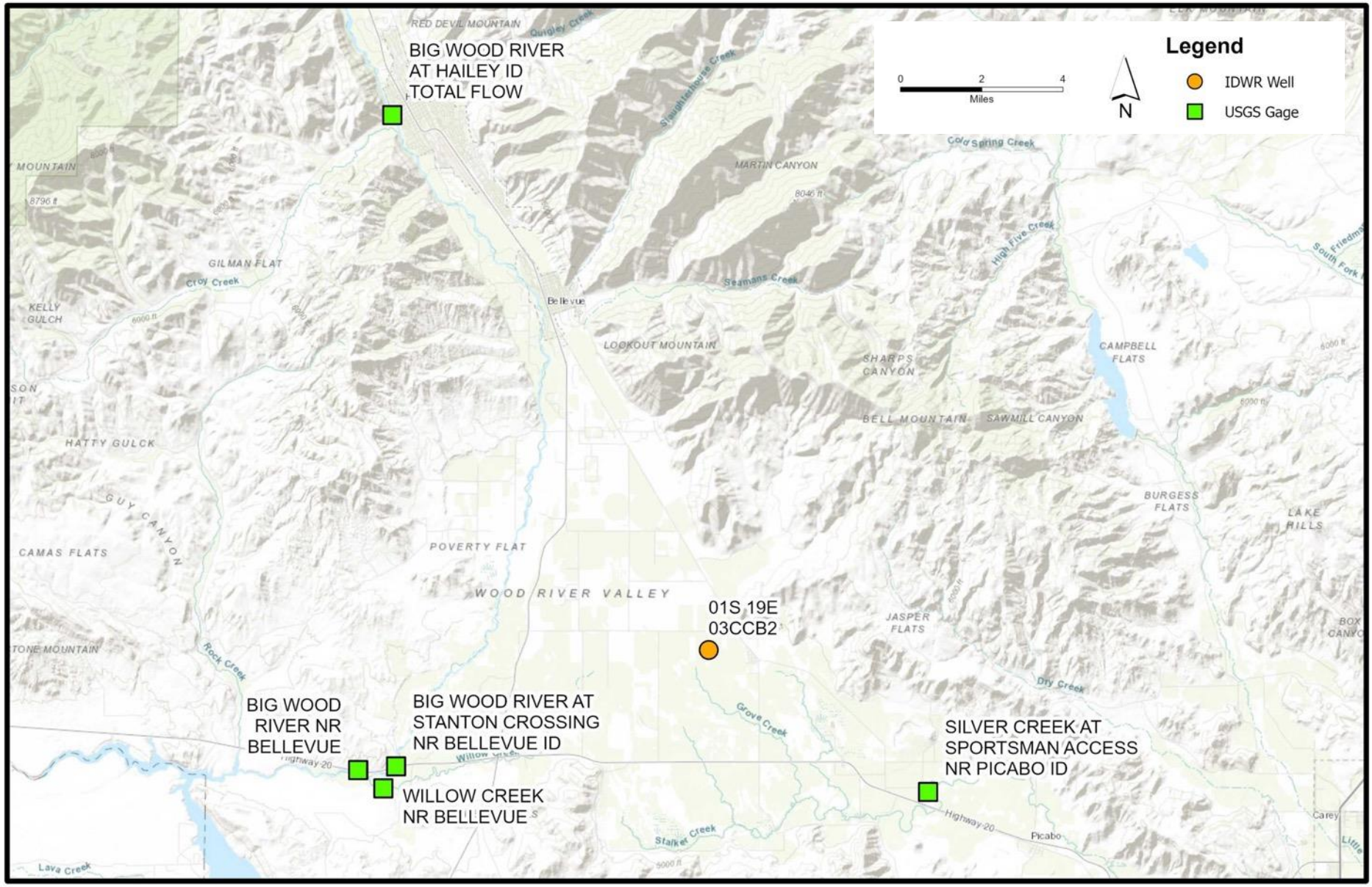
Technical Presentation

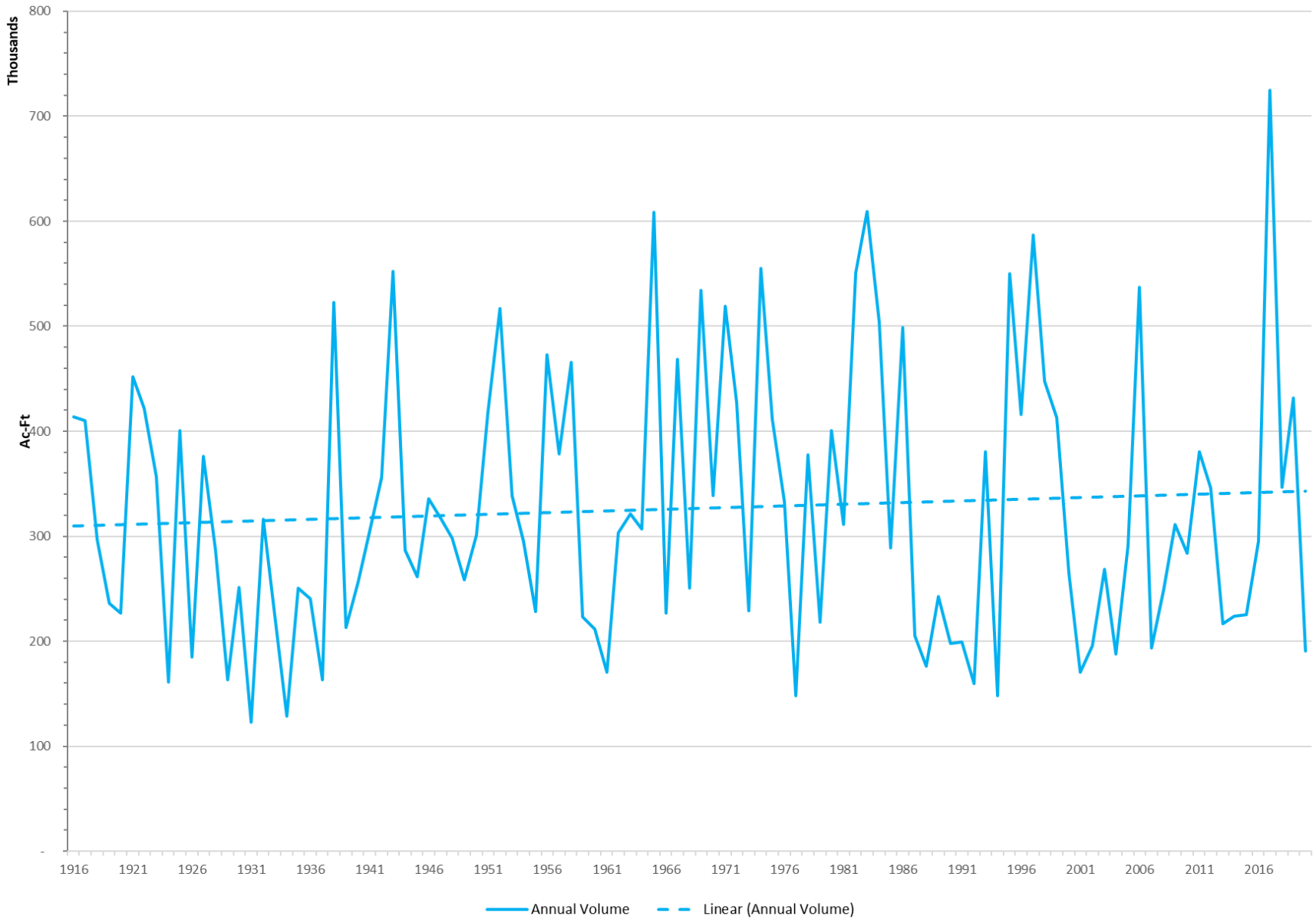
Big Wood Groundwater Management Area

Hydrology

Dave Shaw



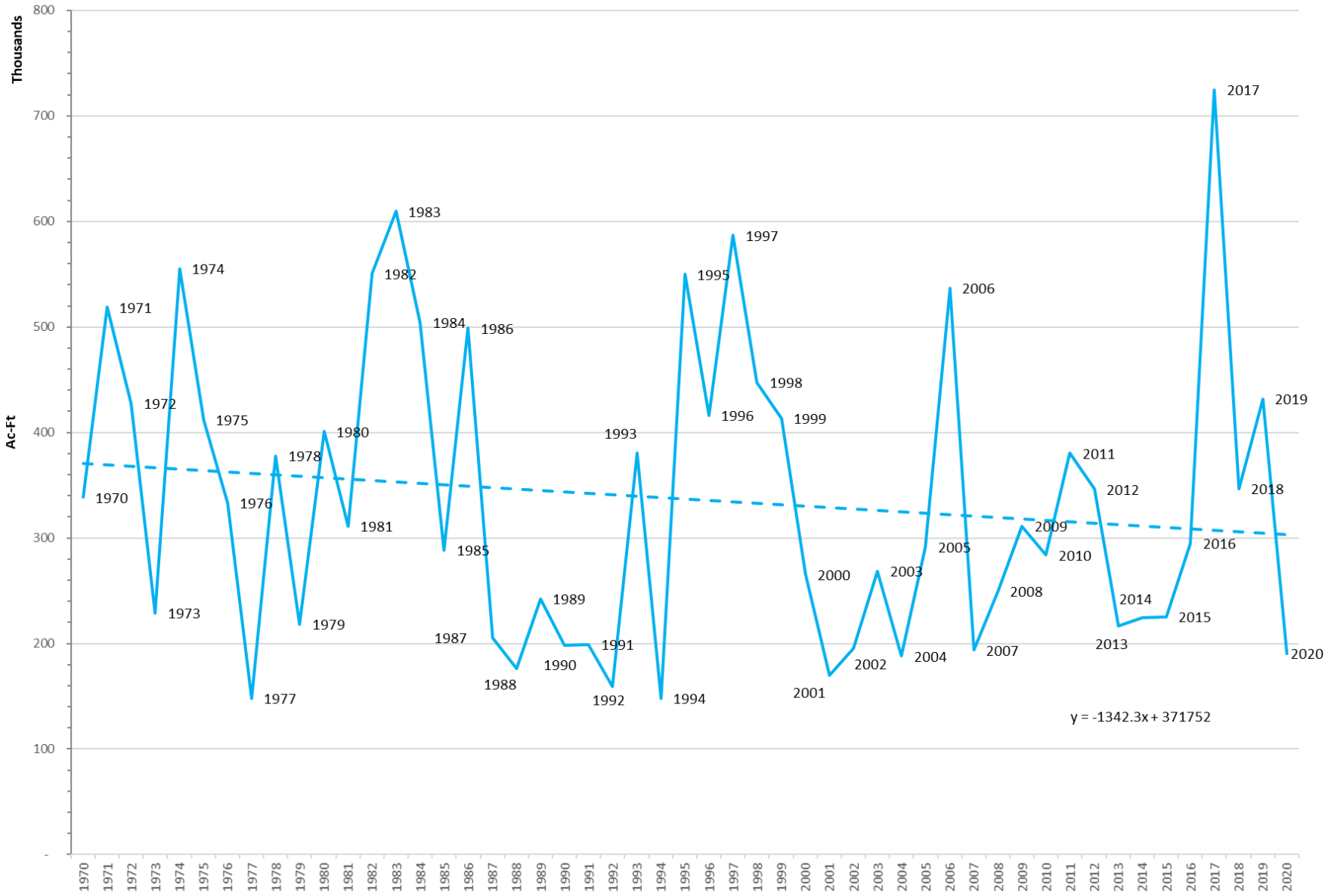
Map // Gage Locations – Big Wood & Silver Creek



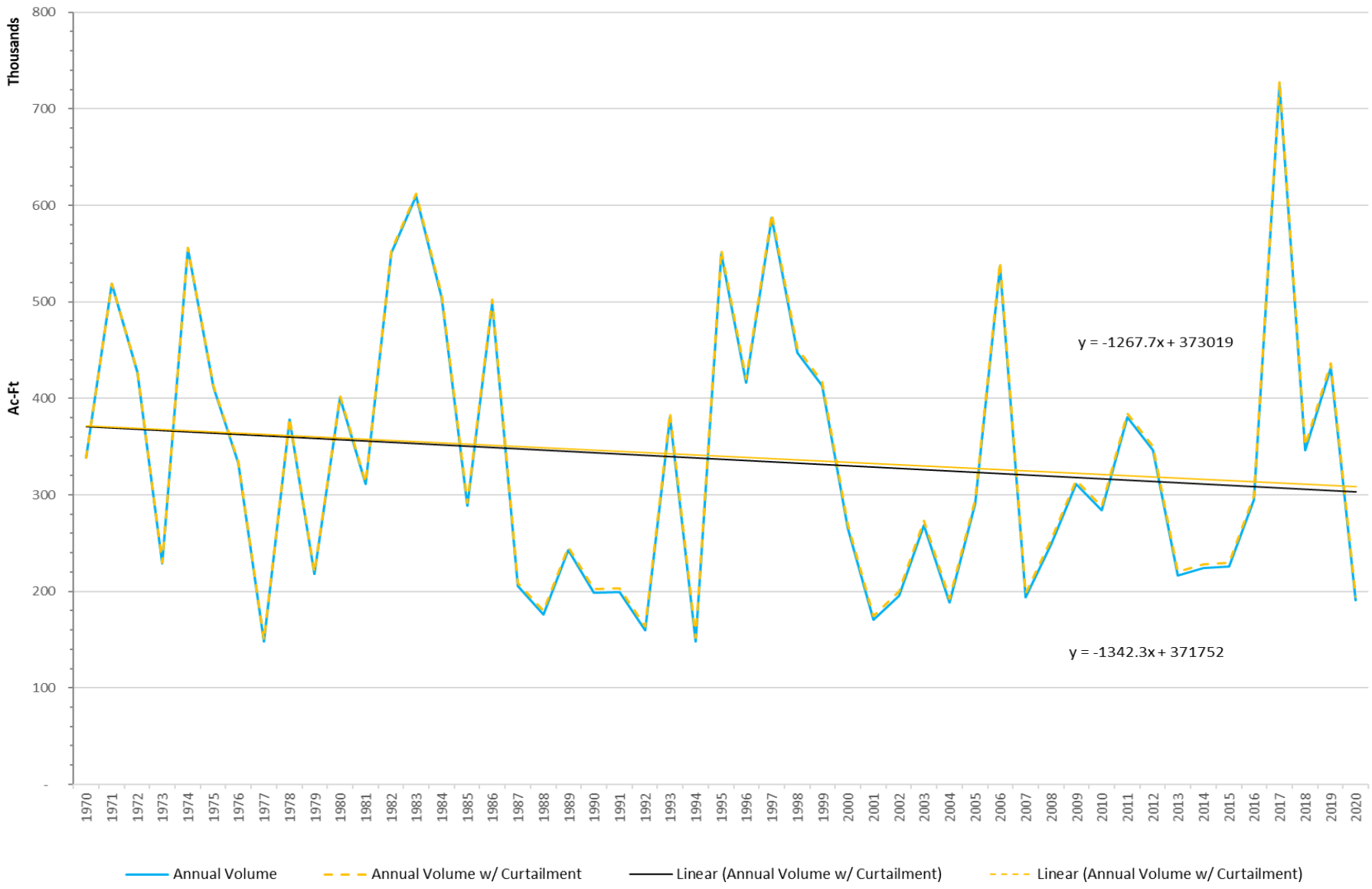
Big Wood River // Annual Discharge Hailey Gage 1916-2020

Big Wood River @Hailey // Mann-Kendall Trend Analysis 1915-2020

Month	Tau	P-value
January	0.108	0.10086
February	0.113	0.086445
March	0.215	0.0011157
April	0.0597	0.36619
May	0.0113	0.86559
June	0.0223	0.73703
July	-0.00162	0.98258
August	0.0268	0.68619
September	0.0309	0.64062
October	0.073	0.26887
November	0.0615	0.35189
December	0.00323	0.96298



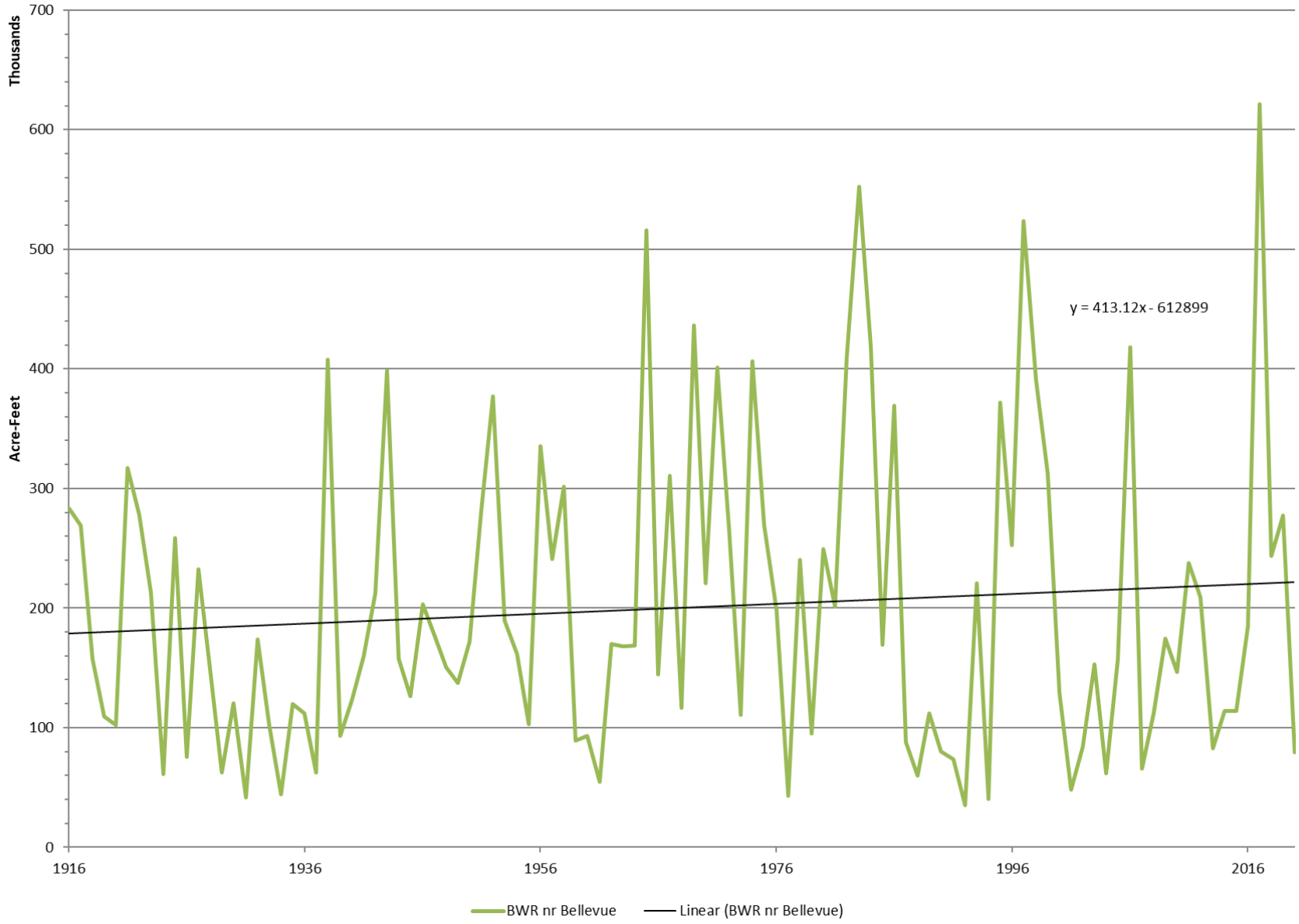
Big Wood River // Annual Volume Hailey Gage 1970-2020



Big Wood River // Annual Volume Hailey Gage 1970-2020

Big Wood River @Hailey // Mann-Kendall Trend Analysis 1960-2020

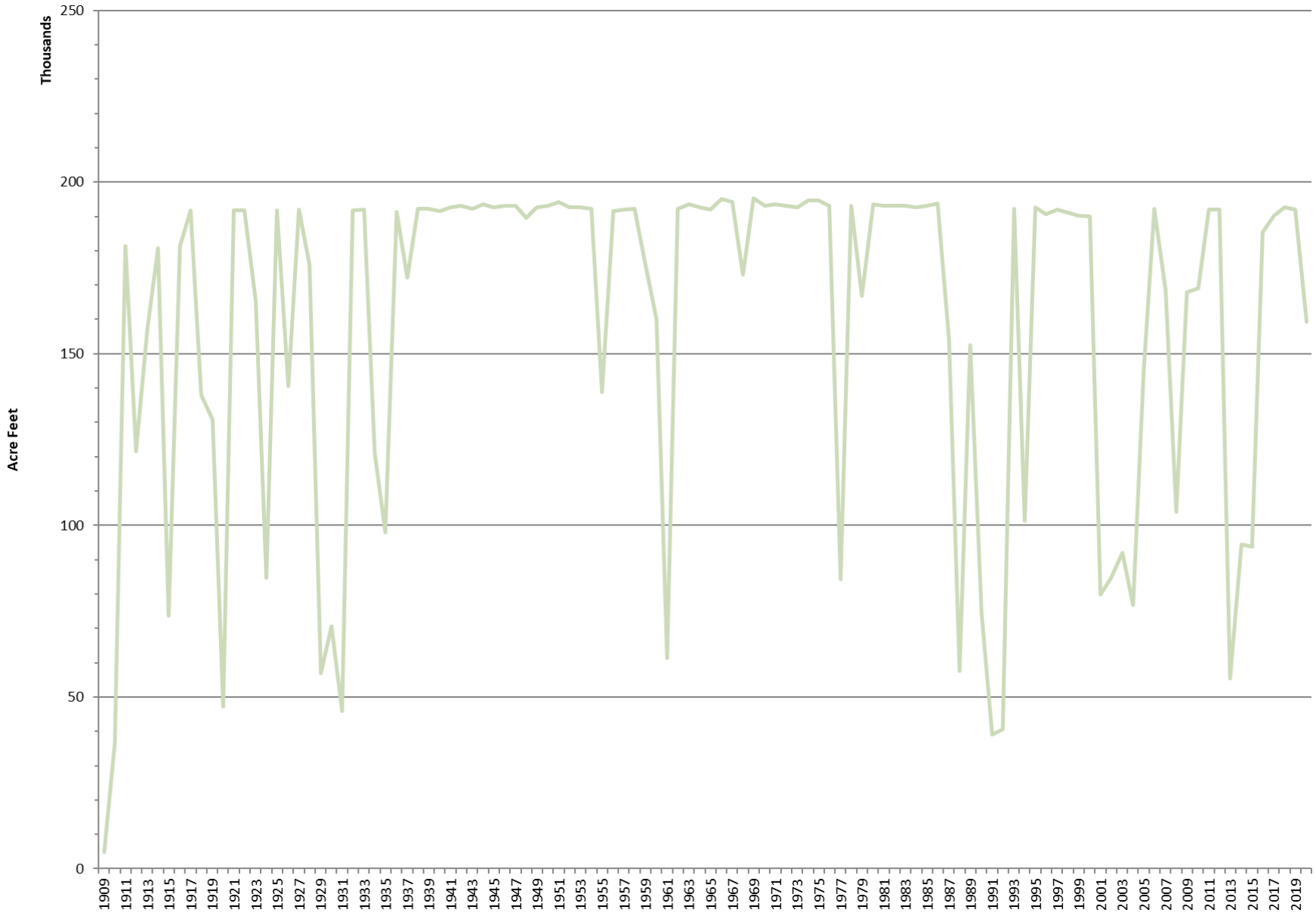
Month	Tau	P-value
January	-0.0579	0.51349
February	-0.0361	0.68585
March	0.126	0.15414
April	0.0492	0.57969
May	-0.0109	0.90588
June	-0.0842	0.34104
July	-0.0896	0.31042
August	-0.138	0.1183
September	-0.17	0.05295
October	-0.0634	0.47422
November	-0.0929	0.29295
December	-0.129	0.14364



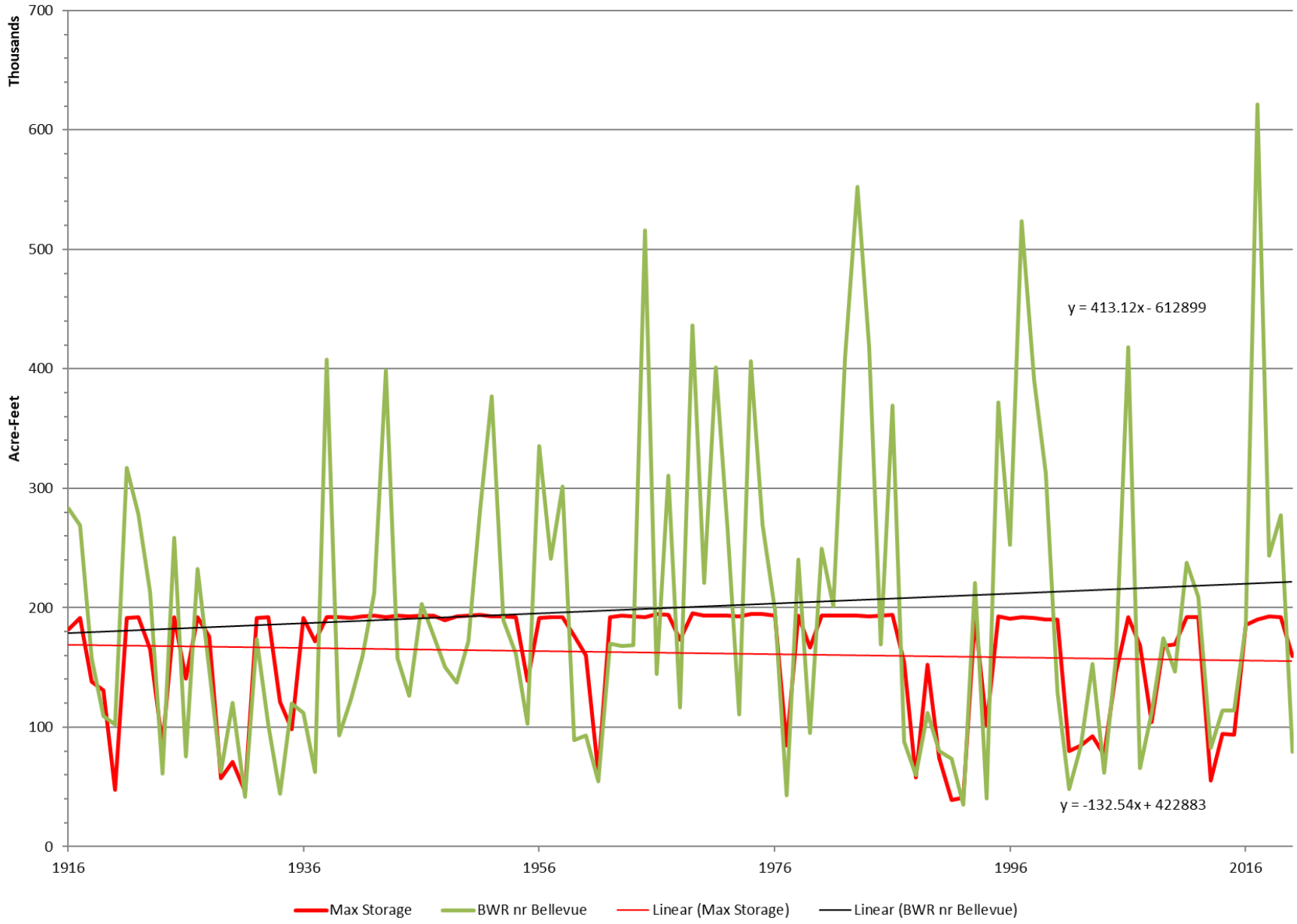
Big Wood River // Annual Volume Near Bellevue Gage 1916-2020

Big Wood River @Stanton Crossing // Mann-Kendall Trend Analysis 1960-2020

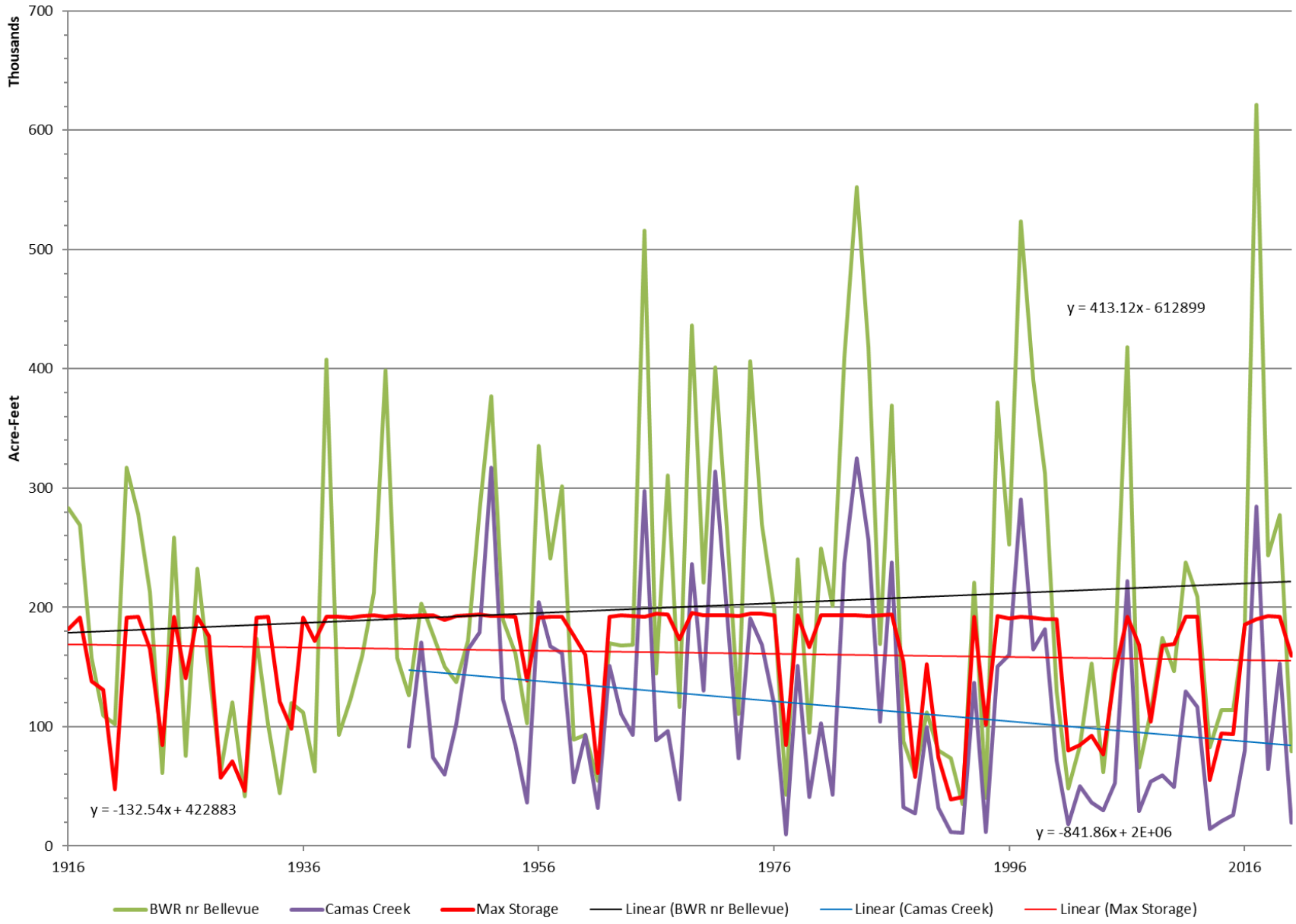
Month	Tau	P-value
January	-0.217	0.013493
February	-0.115	0.1934
March	0.0175	0.84703
April	-0.024	0.78902
May	0.0109	0.90588
June	-0.047	0.59684
July	-0.145	0.099133
August	-0.208	0.018042
September	-0.217	0.013493
October	-0.0497	0.57543
November	-0.0503	0.5712
December	-0.177	0.044431



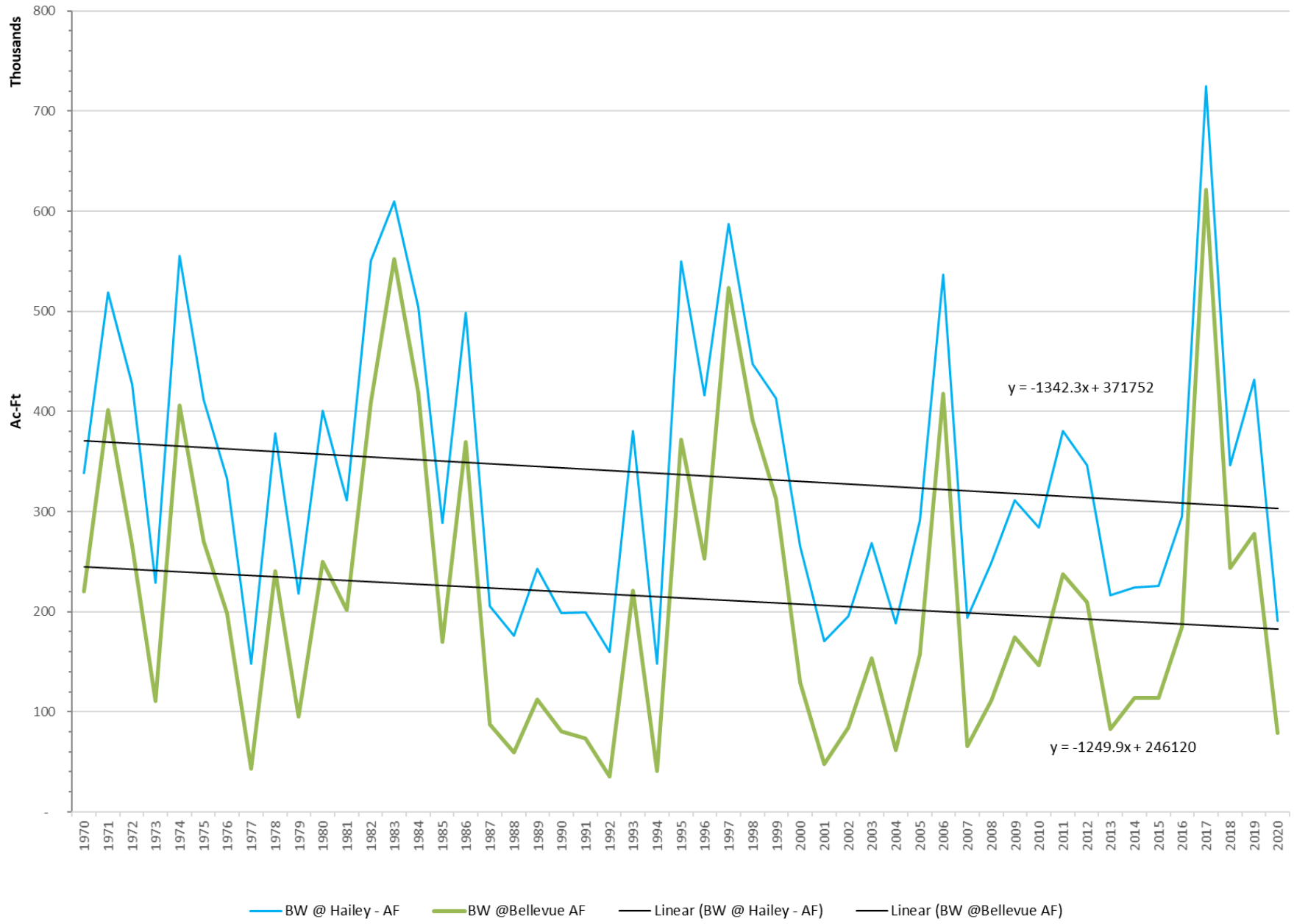
Magic Reservoir // Maximum Storage 1909-2020



Big Wood River nr Bellevue vs. Magic Reservoir Storage



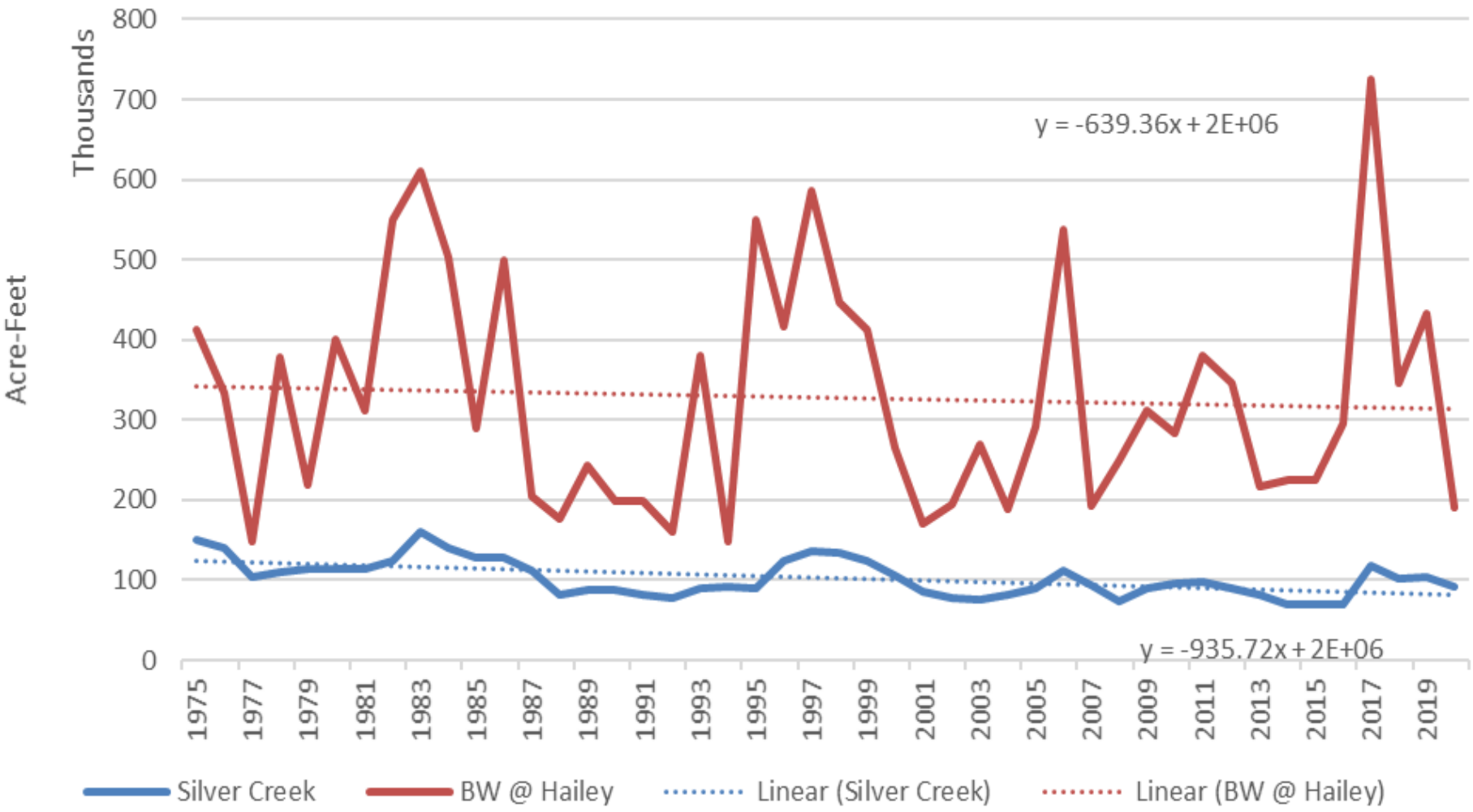
Big Wood River nr Bellevue and Camas Creek vs. Magic Reservoir Storage



Big Wood River // Hailey and nr Bellevue Gage 1970-2020

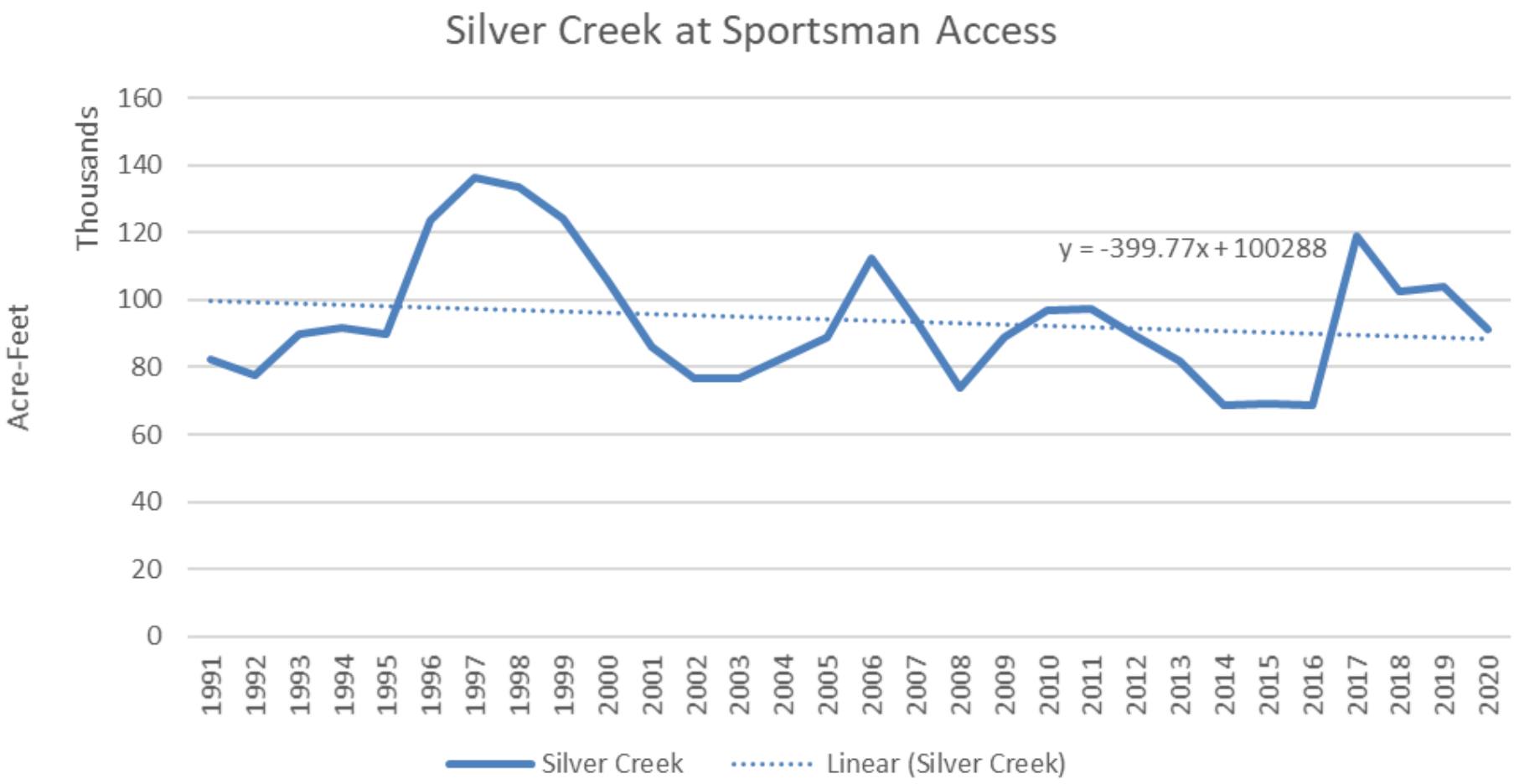
USGS Gage // Trend Analysis Difference 1960-2020

Month	Delta Tau	CFS over Period of Record	Volume (acft)
January	-0.16	-9.55	-587
February	-0.08	-4.73	-263
March	-0.11	-6.51	-400
April	-0.07	-4.39	-261
May	0.02	1.31	80
June	0.04	2.23	133
July	-0.06	-3.32	-204
August	-0.07	-4.20	-258
September	-0.05	-2.82	-168
October	0.01	0.82	51
November	0.04	2.56	152
December	-0.05	-2.88	-177
Total			-1903



Big Wood River at Hailey // Silver Creek at Sportsman 1975-2020

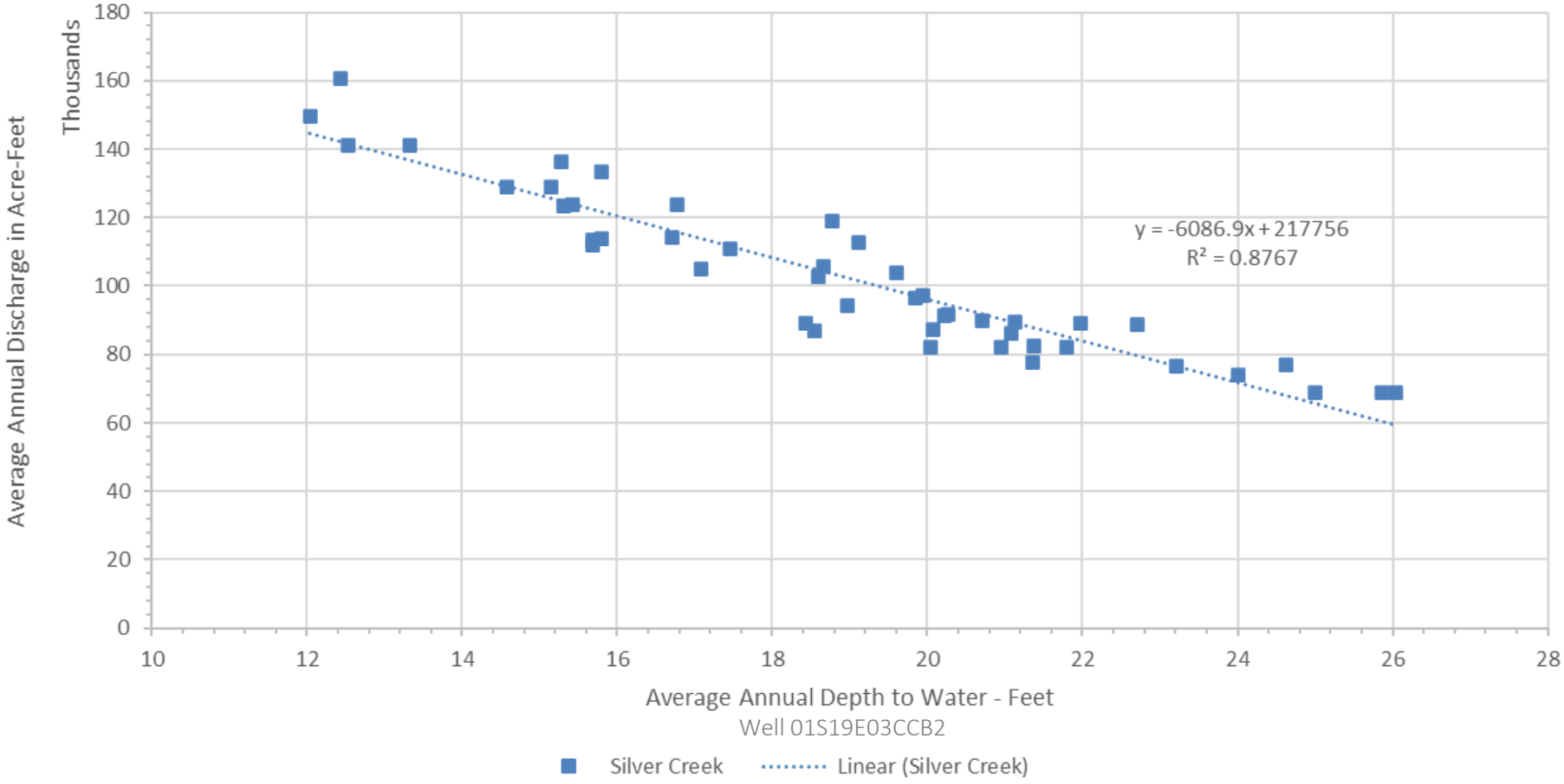
Silver Creek at Sportsman // District 45 Diversions 1970-2020



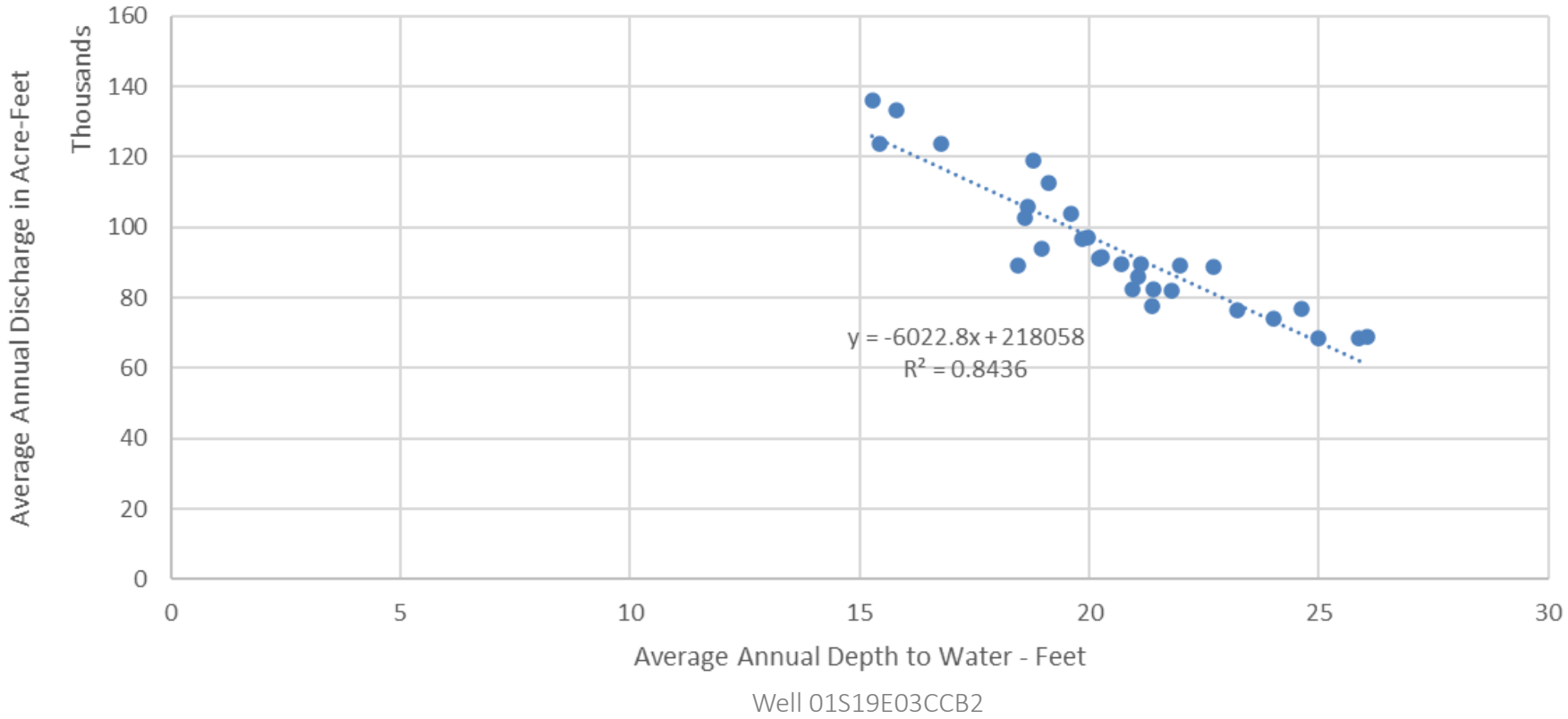
Silver Creek at Sportsman // 1991-2020

USGS Gage – Silver Crk @ Sportsman's // Trend Analysis Difference 1975-2020

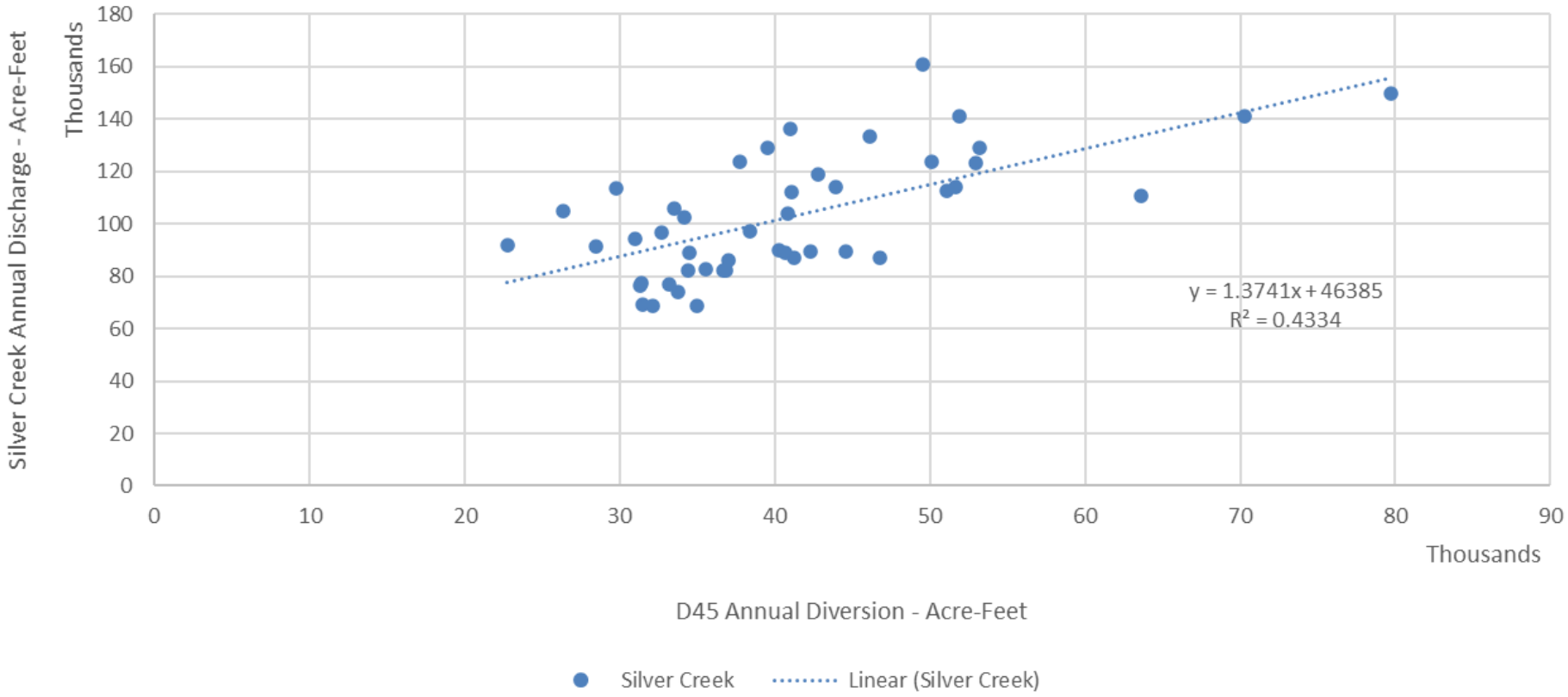
Month	Tau	P-value
January	-0.34	0.000889
February	-0.301	0.003331
March	-0.214	0.037252
April	-0.246	0.016176
May	-0.152	0.13967
June	-0.138	0.17879
July	-0.326	0.001466
August	-0.343	0.000803
September	-0.382	0.000191
October	-0.368	0.000321
November	-0.363	0.000384
December	-0.343	0.000803



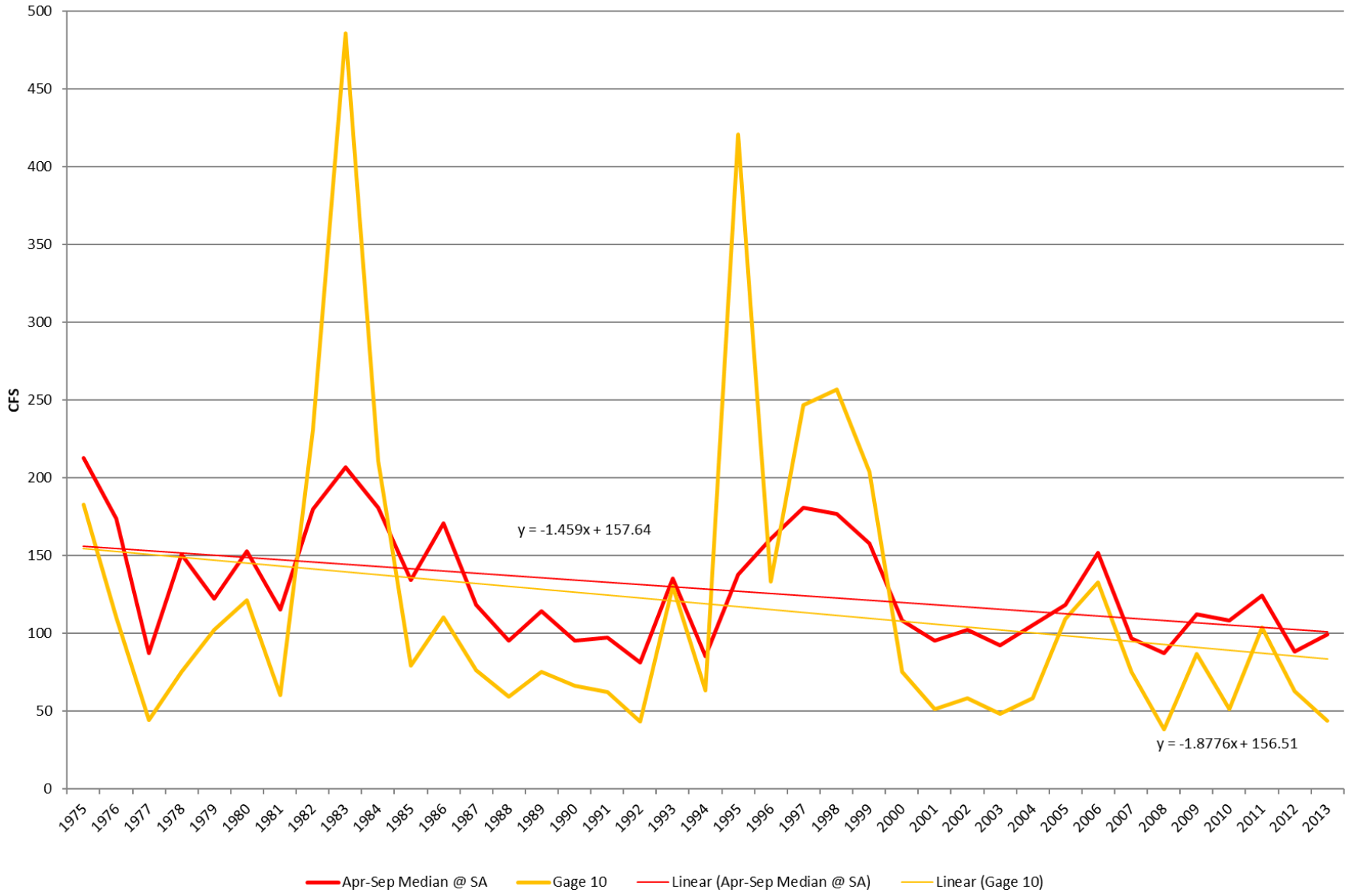
Silver Creek at Sportsman vs Well 01S19E03CCB2 // 1975-2020



Silver Creek at Sportsman vs Well 01S19E03CCB2 // 1991-2020



Silver Creek at Sportsman vs District 45 Diversions // 1975-2020



Silver Creek at Sportsman vs Little Wood at Richfield // 1975-2017

Silver Creek at Hwy 93 // 2020

Technical Presentation

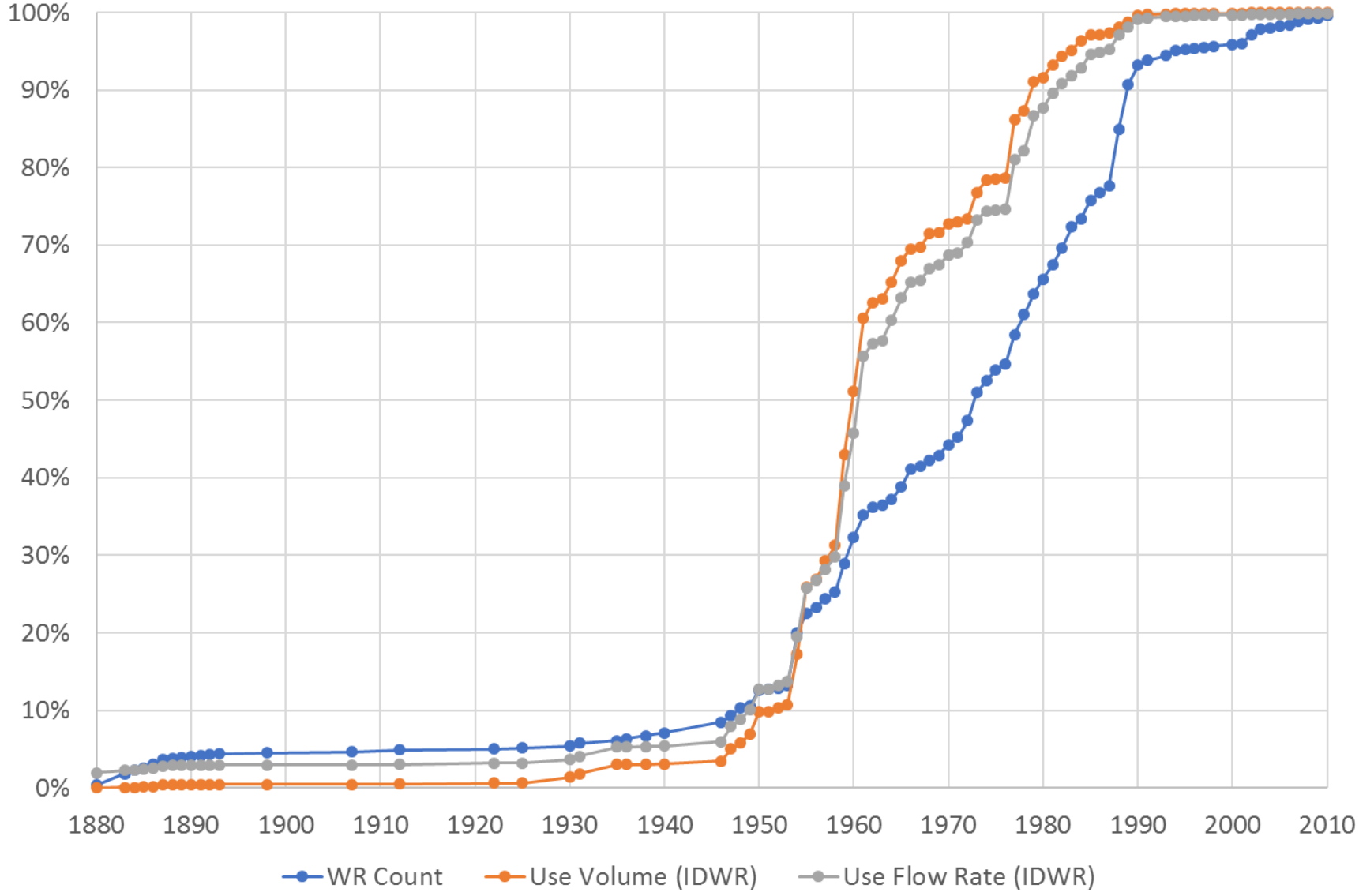
Big Wood Groundwater Management Area

Water Consumption and Statistical Analyses

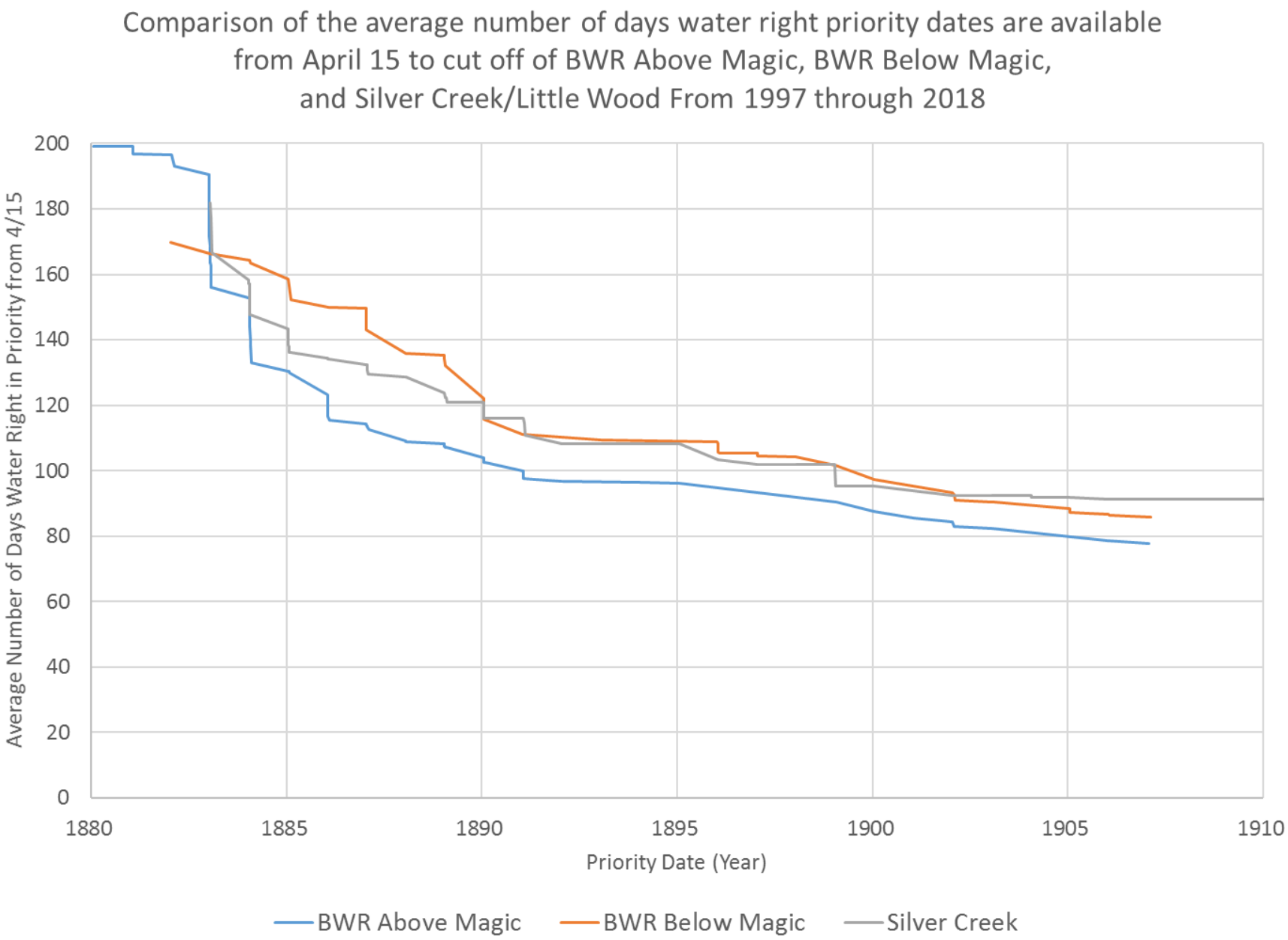
Erick Powell

Injury, Water Right Priority and Plan

- Quasi-injury is not a term defined or recognized by the State of Idaho
- IDAPA 37.03.11(13). **Junior-Priority.** A water right priority date later in time than the priority date of other water rights being considered.
- IDAPA 37.03.11(14). **Material Injury.** Hindrance to or impact upon the exercise of a water right caused by the use of water by another person as determined in accordance with Idaho Law, as set forth in Rule 42.



Groundwater Development Wood River Valley // 1880-2010



Water Right Priority Date Cut-Off // 1997-2018

Surface Water Priority Cuts (1997 – 2018)

- **Above Magic Reservoir compared to Below Magic Reservoir**
  - All Priority Dates: Below Magic rights are delivered on average for 13.8 more days than above Magic
  - Prior to 1900 Priority Dates: Below Magic rights are delivered on average for 16 more days than above Magic
- **Above Magic Reservoir compared to Silver Creek**
  - All Priority Dates: Silver Creek rights are delivered on average for 11.4 more days than above Magic
  - Prior to 1900 Priority Dates: Silver Creek rights are delivered on average for 11.2 more days than above Magic

Water Use Efficiency

National Engineering Handbook – Part 623 (USDA)

- Irrigation Efficiency (E_i): Ratio of the average depth of irrigation water that is beneficially used to the average depth of irrigation water applied, expressed as a percentage.

Efficiency - BWLWWUA assumes 90% for all diversions

Evaluation of Water Use Efficiencies

Six different types of water uses were evaluated for efficiency

Snow Making Efficiency
WR No. 37-8575A

Diversion in non-irrigation season for snowmaking

Consumptive use: 53.6 to 74.5 acft (avg of 62.6 acft).

18% - 25% Efficiency

Large Residential
Valley Club Owners

159.97 ac ft (2018 METRIC CIR: 0.70 ft) 208.65 ac ft for Irrigation

Irrigation Efficiency: 76.7% (159.9/208.6)

Municipal Efficiency
SV Water/Sewer

Treatment: 692.5 ac ft

Irrigation Estimate:78 %

Irrigation Efficiency: Assume 76.7%

Individual User Efficiency
WR No. 37-22328

3.40 acft (2018 METRIC CIR: 0.38 ft)

Diverted: 9.6 ac ft

Irrigation Efficiency: 35.4%

Individual User Efficiency
WR No. 37-8011A

2.45 acft (2018 METRIC CIR: 0.77 ft)

Diverted: 10.28 ac ft

Irrigation Efficiency: 23.8%

Agricultural Irrigation Efficiency

2018 Delivery to Irrigation: 772.3 ac ft

648.8 ac ft (2018 METRIC CIR: 1.54 ft)

Irrigation Efficiency: 84%

Evaluation of Water Use Efficiencies

Water Use Evaluated	Name / Water Right	Measured Volume (acft)	90% CU (acft)	Refined CU (acft)
Municipal Efficiency	SV W & S	3137.4	2823.7	1877.0
Snow Making Efficiency	SVC (37-8575A)	298.0	268.2	62.6
Large Residential Efficiency	VCOA	267.5	240.8	160.0
Individual User Efficiency	37-22328	9.6	8.6	3.4
Individual User Efficiency	37-8011A	10.3	9.3	2.4
Large Agricultural Efficiency	Silver Spring Ranch	772.3	695.1	648.8
	Total	4495.1	4045.7	2754.2
	Efficiency		90%	61.3%

USGS Gage – BWR at Stanton Crossing (1960-2020) Mann-Kendall Trend Analysis Difference – with Simulated 20,000 acft Recharge Diversion (2000-2020)

Month	Tau	Probability
January	-0.0579	0.51349
February	-0.0361	0.68585
March	0.126	0.15414
April	-0.104	0.23952
May	-0.0344	0.69962
June	-0.0831	0.34737
July	-0.0896	0.31042
August	-0.138	0.1183
September	-0.17	0.05295
October	-0.0634	0.47422
November	-0.0929	0.29295
December	-0.129	0.14364

Technical Presentation

Big Wood Groundwater Management Area

Comments Regarding Numbers Presented on behalf of the Surface Water Users

Dave Shaw

Estimated 2020 Hydrologic System Impacts

MONTH	SILVER CREEK IMPACTS		BIG WOOD RIVER IMPACTS		CAMAS PRAIRE IMPACTS	
	(AC-FT)	(CFS)	(AC-FT)	(CFS)	(AC-FT)	(CFS)
Jan	1,114	18.12	944	15.35	855	13.24
Feb	837	**15.07**	706	**12.71**	**855**	**13.24**
Mar	791	12.87	876	14.24	855	13.24
Apr	819	**13.76**	776	**13.05**	**855**	**13.24**
May	1,578	25.66	1,578	25.66	855	13.24
Jun	1,975	**33.20**	2,049	**34.43**	**855**	**13.24**
Jul	3,175	51.64	2,376	38.50	855	13.24
Aug	3,282	**53.37**	2,686	**43.68**	**855**	**13.24**
Sep	2,921	49.09	2,247	37.76	855	13.24
Oct	2,536	**41.25**	2,015	**32.78**	**855**	**13.24**
Nov	1,853	31.14	1,558	26.17	855	13.24
Dec	1,552	**25.24**	1,300	**21.15**	**855**	**13.24**
Total	22,434 (AC-FT)		19,102 (AC-FT)		10,260 (AC-FT)	
Total Irrigation Season	**13,750 (AC-FT)**		**11,703 (AC-FT)**		**5,558 (AC-FT)**	
Total Non-Irrigation Season	8,684 (AC-FT)		7,398 (AC-FT)		4,702 (AC-FT)	

Page from Eric Miller's 1-21-2021 Presentation

Modeled Impacts for Big Wood River below Heart Rock Ranch

MONTH	BELOW HEART ROCK RANCH IMPACTS (AC-FT)
Jan	330
Feb	**247**
Mar	306
Apr	**272**
May	552
Jun	**717**
Jul	828
Aug	**940**
Sep	786
Oct	**705**
Nov	545
Dec	**455**
Total	**6,686**
Total Irrigation Season	**4,096**
Total Non-Irrigation Season	**2,589**

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Estimated 2020 Quasi-Injury Estimates

IMPACT TYPE	SILVER CREEK IMPACTS (AC-FT/Y)	BIG WOOD RIVER IMPACTS (AC-FT/Y)	CAMAS PRAIRE IMPACTS (AC-FT/Y)
General Irrigation Season	**13,750**	**761[1]**	**5,558**
General Non-Irrigation Season	0	7,398	4,702
Stockwater	**30**	**0**	**0**
Below HRR Irrigation Season	0	4,095[2]	0
Sub-Totals	**13,780 Ac-ft/y**	**12,254 Ac-ft/y**	**10,260 Ac-ft/y**
Totals	36,294		

Note 1: represents 10% of impacts during the irrigation Above Heart Rock Ranch (HRR) to account for surface water diversions in the triangle junior to Magic's Impoundment Rights.

Note 2: represents impacts during the irrigation season on the Big Wood River Below HRR from April 1 – September 30

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Conclusions

- From a System's perspective GW Pumping is one big zero-sum game.
- Current modeling and impact/injury estimates do not address the full system or material injury that has occurred from the beginning of groundwater pumping. Groundwater mining, and associated impact/injury that may have occurred prior to 1995 has not yet been quantified.
- Published reports and preliminary analysis suggest that groundwater depletion may still be occurring.
- Current System Impacts are Approximately 50,500 ac-ft/yr and have likely resulted in the system in a Depleted Equilibrium relative to systems conditions Circa 1905.
- Current "Quasi-Injury" is estimated to be approximately 36,300 ac-ft/y
- At present, Advisory Committees efforts under the framework of a "Ground Water Management Plan" are considered the best means through which individual injuries can be indirectly addressed by focusing on efforts to "protect the people of the state from depletion of groundwater resources" as required under the Ground Water Act (Idaho Code 42-231).

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IDAHO Department of Water Resources

Ground Water Conditions Throughout Idaho

IWUA Annual Conference

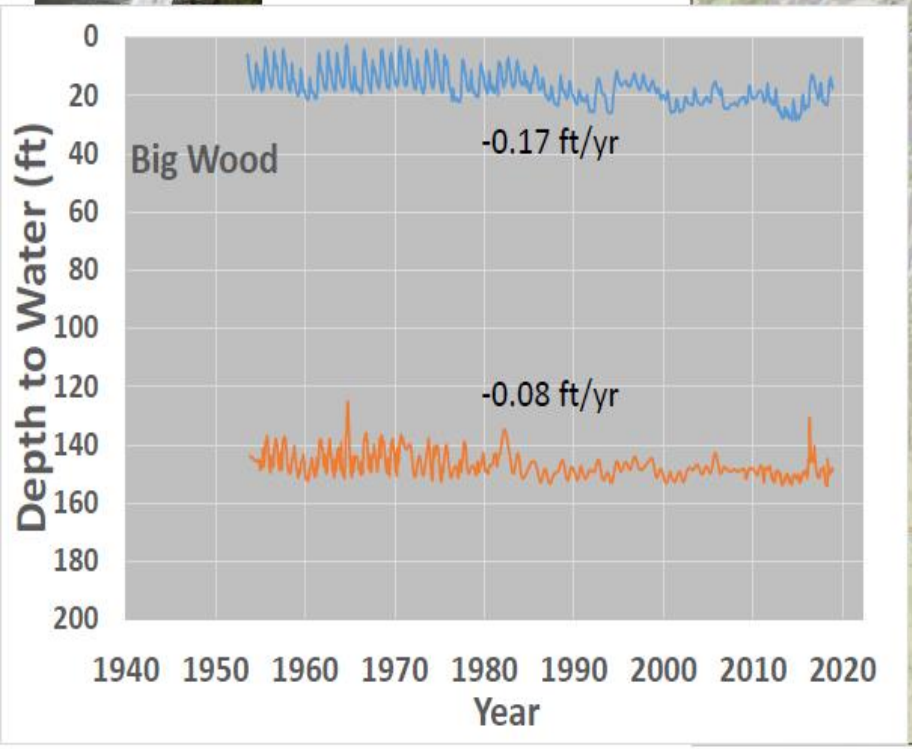
Craig Tesch, P.G.

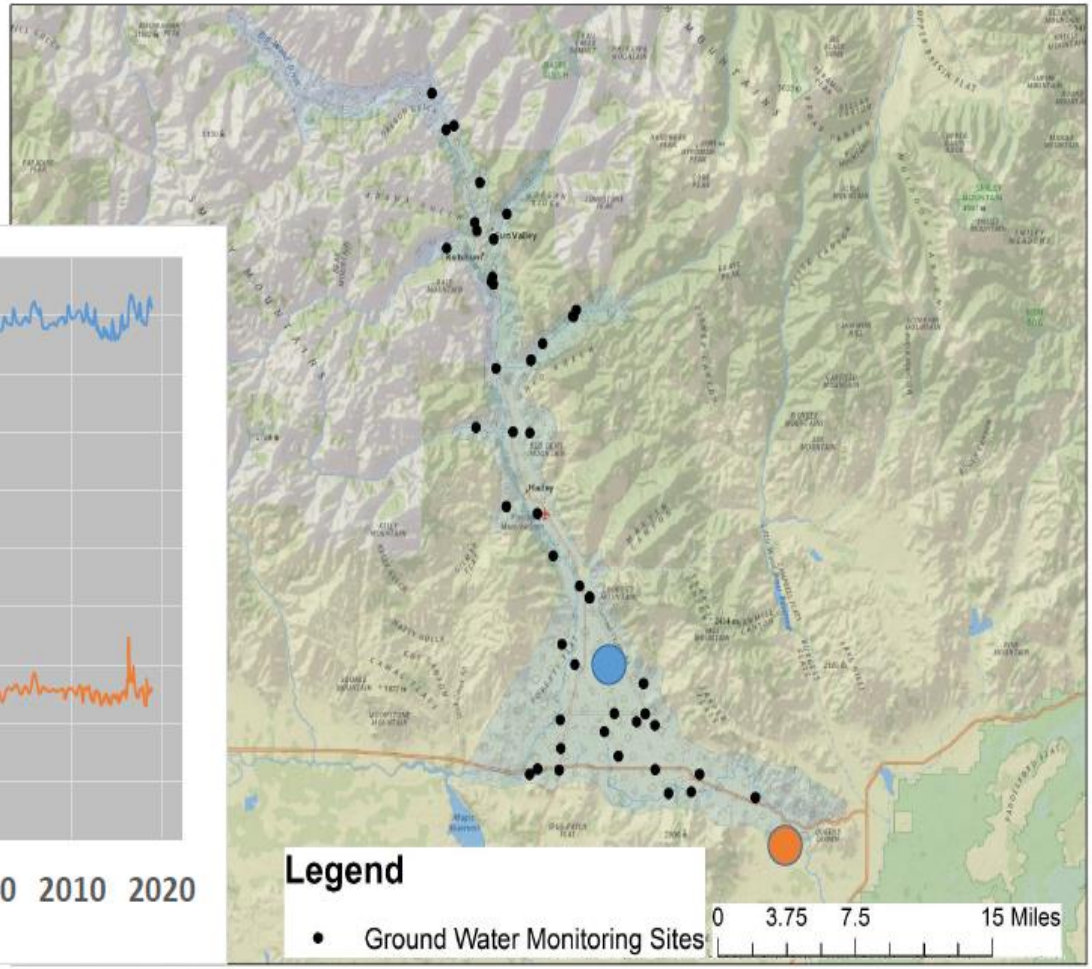
IDWR

January 21, 2020

Cover of Craig Tesch's January 21, 2020 Presentation

Big Wood - Hydrographs





Craig Tesch's Hydrographs for the Big Wood Upper Basin

Idaho Department of Water Resources
Open-File Report

Summary of Ground Water Conditions in the Big Wood River Ground Water Management Area

2019 Update

By
Allan Wylie

September 2019

Cover of Allan Wylie's September 2019 Report

The Big Wood GWMA was formed in 1991, in part because the water-table was declining, so a declining water-table for a period beginning prior to 1991 is not unexpected. A more useful analysis would be to evaluate the trend since formation of the GWMA to determine if the administrative action is having its intended impact. Table 4 shows the Mann-Kendall statistics for wells in the Wood River Valley (Figures 2 and 3) including only data collected since 1991. T, S, z, and Δ are all positive indicating rising groundwater-levels. However p is only statistically significant at the 95% confidence interval for the April data; the October and November data do not show a statistically significant trend. Perhaps the October and November data contain enough noise that the trend is masked, or perhaps there is no trend and the water-table is stable. The April groundwater increase is about 0.18 ft/yr.

Table 4. Mann-Kendall analysis for Wood River Valley wells beginning in 1991.

Kendall Statistics	October	November	April
locations	46	43	43
T	0.111	0.041	0.182
S	55	29	67
z	1.644	0.538	2.356
p	0.1001	0.5908	0.0185
Δ	0.09833	0.062	0.18

Page from Allan Wylie's September 2019 Report

Summary

Big Wood Groundwater Management Area

Presentation

Summary and Conclusions

- Changes in runoff (discharge) in the Big Wood basin since the 70's are primarily due to changes in climatic conditions, are similar to changes in river systems throughout Southern Idaho and are not the result of ground water pumping.
- Mann-Kendall statistical analysis is the recommended tool to analyze actual changes is discharge over time and those results are provided for everyone's review.
- Allan Wylie's analysis shows ground water levels are stabilizing or have stabilized since the Ground Water Management Area was created in 1991.
- Reduced surface water diversions onto the Bellevue Triangle have reduced the recharge that supplies Silver Creek and the discharge of Silver Creek can be improved by restoring those diversions.
- The ground water users look forward to the opportunity to engage in meaningful discussions to develop a Ground Water Management Plan that will protect all water users in the Big Wood basin.

Questions