385

Arizona State Land Department
May 2016

Presentation to ANSAC: Salt River Navigability - Rebuttal

Overview

- Historical Boating Accounts
- Modern Boating
- Hydrology
- Rating Curves
- Miscellaneous Topics

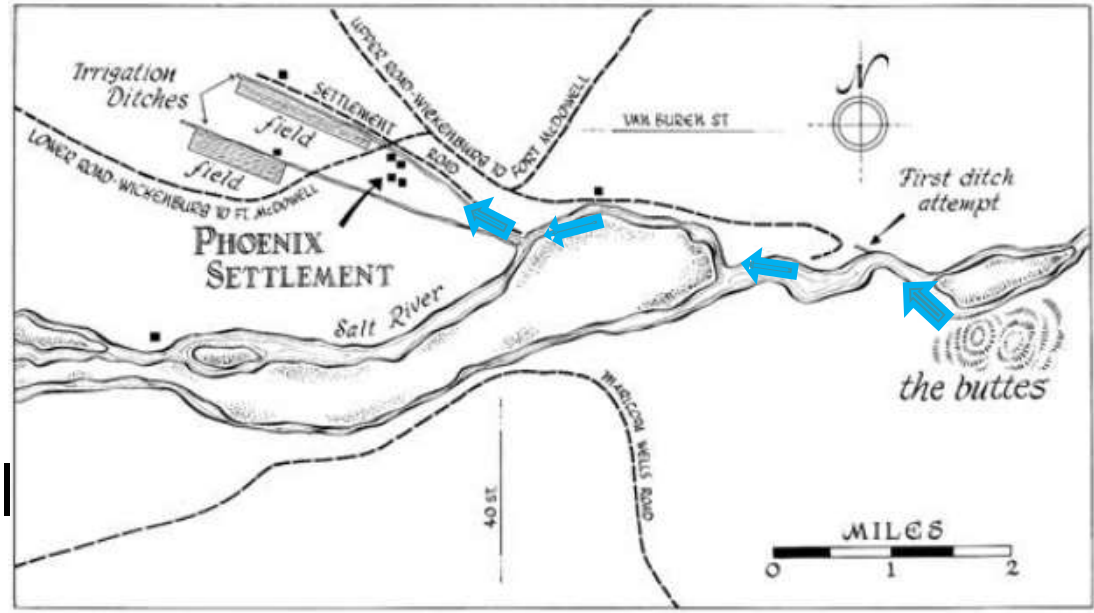
Historical Boating Accounts

Rebuttal of General Criticisms of Historical Navigability Accounts

- Newspapers are reliable sources
- "Boosterism" does not negate news accounts
- Boating accounts really did happen
- Boating occurred within ordinary flow range
- Boating accounts were on river not on canals
- Some boating was commercial
- Nearly all boat trips were successful
- Boating accounts are relevant to navigability
- All trips cited were on the Salt River in Arizona

Historical Boating Accounts

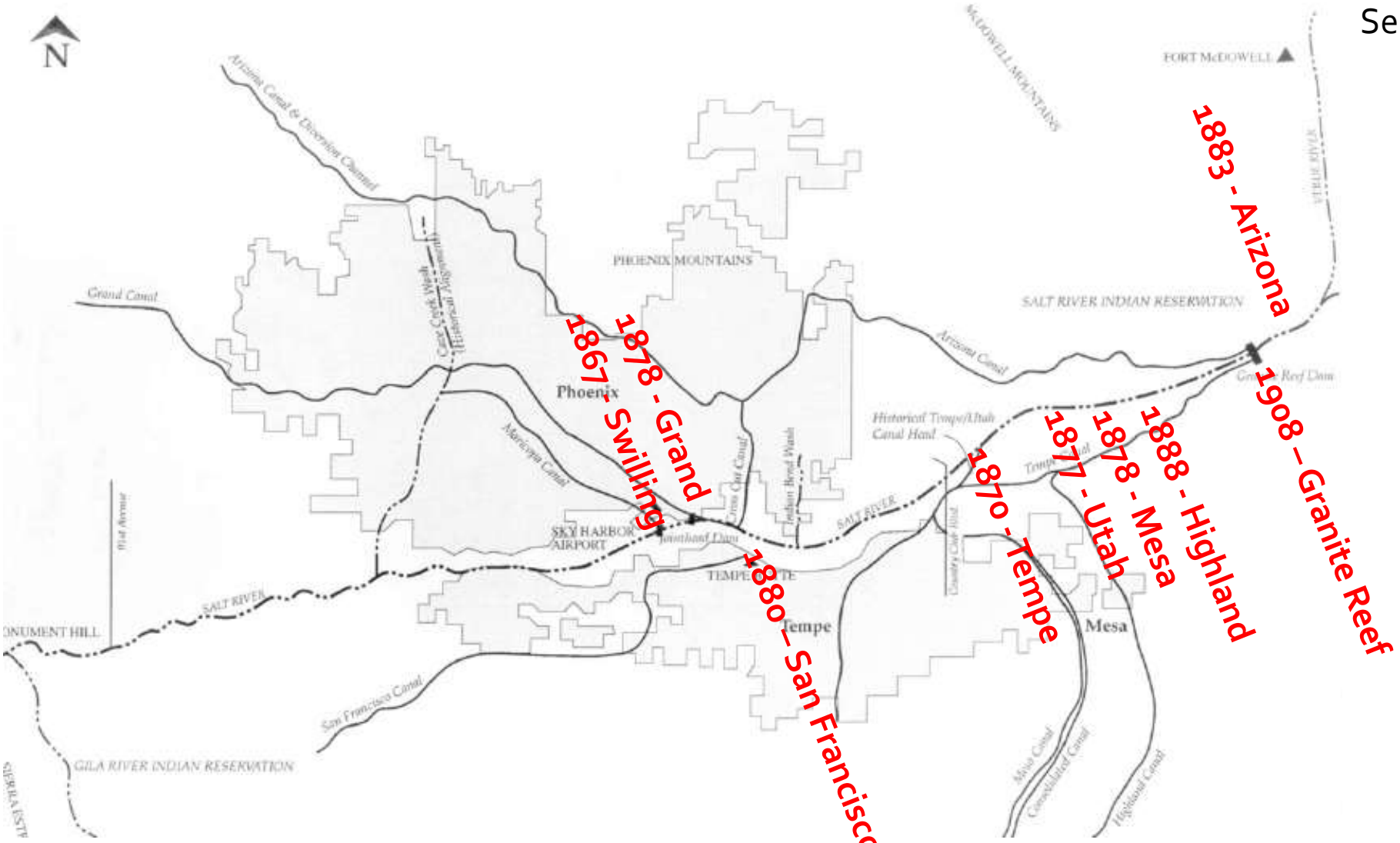
- Flat Boat (April 1873)
  (Segment 6)
  - L. Vandermark & W. Kilgore
  - "Salt is navigable for small craft"
  - Five tons wheat
  - Flat boat
  - Hayden's Ferry to Swilling Canal
  - Canal to Helling's Mill



Sources: Weekly AZ Miner, 5-3-1873
Map: AZPCP.org

Historical Canal Heads: Segment 6

Seg 6



Why Was There No Shipping Industry on the Salt River?

- Diversion dams blocked river traffic starting in 1867
- Diversions depleted flow beginning in 1867
- Transport Alternatives existed:
  - Roads (pre-1867)
  - Railroads (1879 to Maricopa, 1886 to Phoenix/Tempe, 1898 to Globe)
    - East/West connection to USA in 1881.
  - No alternative irrigation source existed
- River travel NOT always less expensive
- Largest early markets and forts not located along the river
  - Prescott, Wickenberg, Tucson, Globe, etc.
- Population along river limited
- Segments 1-5 often not conducive to heavy loads, deep draft boats, upstream travel
- Comparison to Yuma & Colorado River

False: If the Salt River Were Navigable, There Would Be Commercial Shipping

- Ordinary & Natural Condition
- Big Boats, Big Loads
- Upstream Boating
- Population Centers
- Source vs. Market
- Cost
- Risk
- Dams & Diversions
- Roads, Rails & Rivers
- Is this true of other navigable rivers?

Is There Always Commercial Shipping Industry on Navigable Rivers?

- Mississippi River
- Missouri River
- Colorado River
- Weber River
- John Day River
- Mosquito Fork
- Umpqua River
- Rogue River
- Salmon River

False: If a River is Navigable, the Preferred Mode of Travel is by River

- Many Factors Affect Mode of Travel Used
  - See Boating PowerPoint, Slides 68-71
  - Example: The Mormon Battalion
    - Council Bluffs, IA to Kansas City, MO (Missouri River)

Source: www.lds.org – Wickman, 2007

Historical Boating Accounts

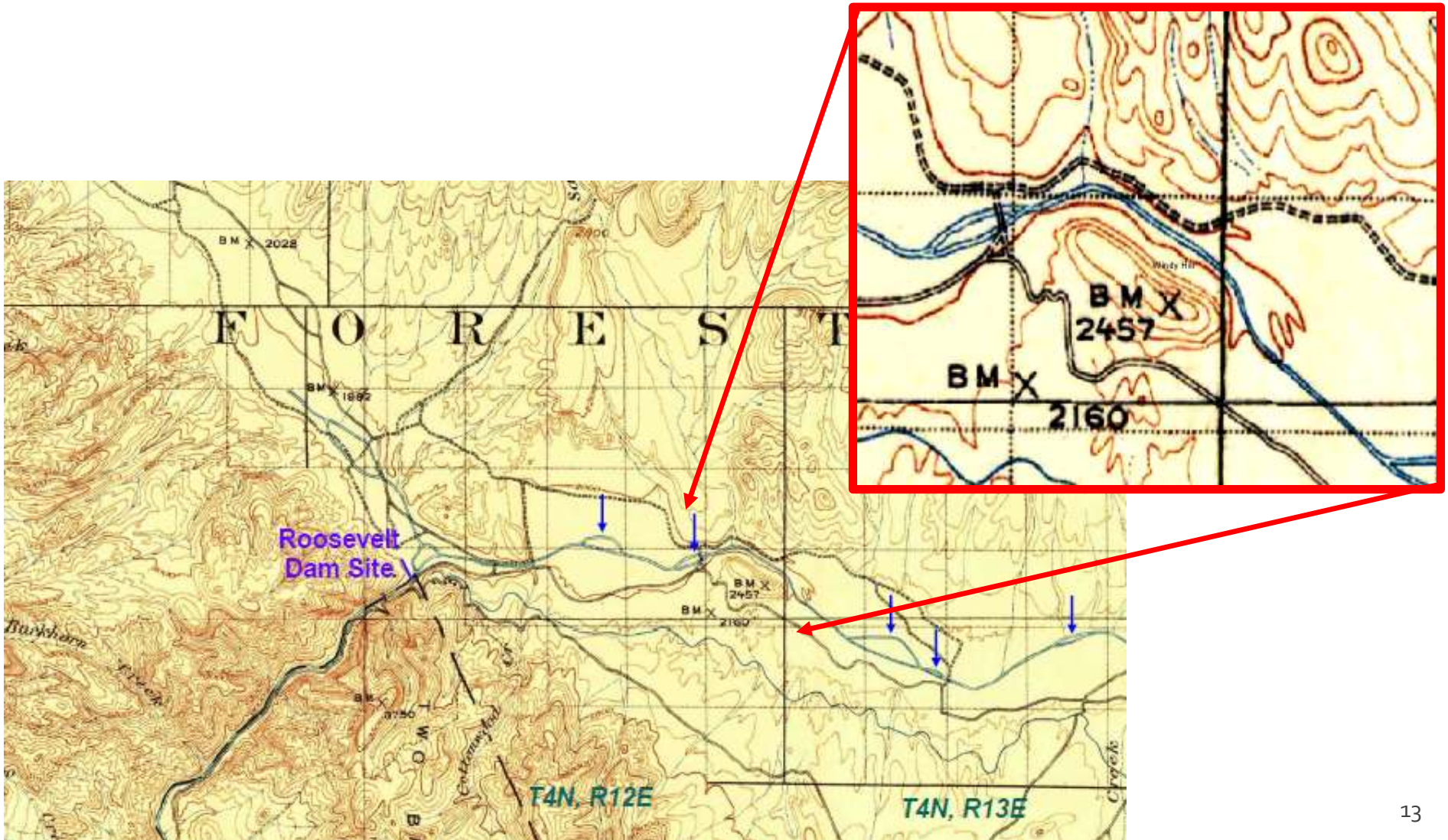
- Charles Hayden – Log Floating Experiment
  - Segment 1? Probably on White or Black River
  - Initial Reconnaissance (6-14-1873)
    - "Headwaters" of Salt River Trip
    - Maine lumberman – Salt R. superior to Maine rivers
  - Canoe Trip (6-21,28-1873)
    - Made canoe from a tree
    - Six men, logs for log drive
    - Abandoned boat
    - Difficulty with rapids & boulders, lost gear
    - Log jam in narrow canyons
  - Hayden's Conclusion: Log floating was a failure

Sources: AZ Citizen, 6-14-1873; AZ Weekly Miner, 6-21,28-1873

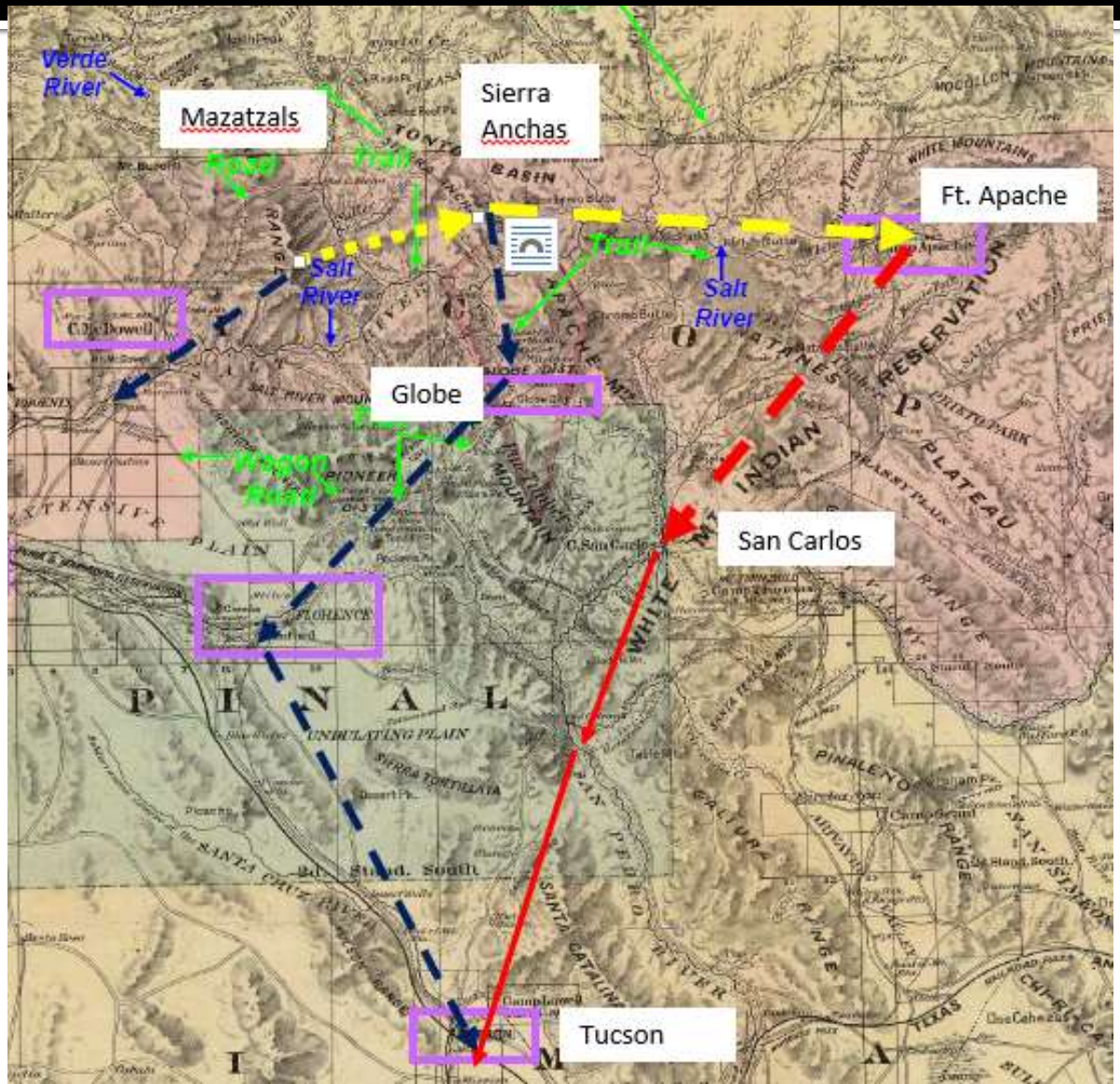
Hayden Log Float (June 1873)

- New Information from *Charles Trumbell Hayden Pioneer* by Carl T. Hayden (p. 42)
  - Trip suggested by Logan, a Hayden employee
    - Carpenter, employed at Ft. Apache.
    - Had boated White & Salt River, Ft. Apache to Tempe
  - Hayden trip occurred after June 24, 1873
  - Hayden decided to forego log-floating because:
    - Logs would lodge in canyon (Segment 1 or White River)
    - Log floats best at high water
    - During floods, couldn't catch logs with a boom

Hayden Log Float (June 1873)



Hayden Log Float (June 1873)



Was this Hayden's Route Back to Tucson?

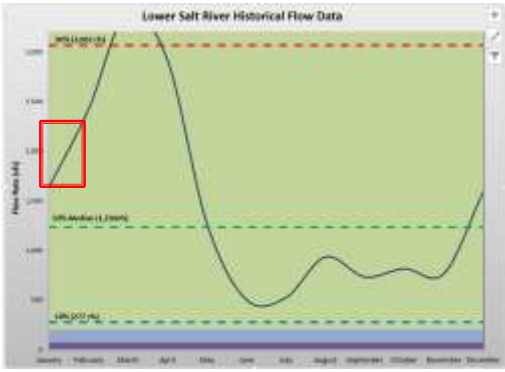
Ft. Apache-San Carlos-Tucson

Why Weren't There Commercial Log Floats if it Were Feasible to Float Logs?

- Market locations
- Other sources of lumber at population centers
- Railroads Arrived
  - Yuma 1877
  - Maricopa 1879
  - Tucson 1880
  - Phoenix 1886
  - Prescott 1886
  - Globe 1898
  - Flagstaff 1882
- Irrigation dams
- Location of Logs
  - Burch: "Main Difficulty" = Logs 10 miles to river
- Lessons from the Weber River

Historical Boating Accounts

- Hamilton, Jordan, & Halesworth (Jan 1879)
  - Segment 6
  - Skiff
    - Built for $10
  - Phoenix to Yuma Trip
    - "river (is) perfectly practicable for navigation"
      - (one spot on Gila River narrowed by rocks)
    - Would easily float a loaded flat boat, drawing 2 ft. of water
    - "Successful"



Sources: Arizona Sentinel 1-25-1879

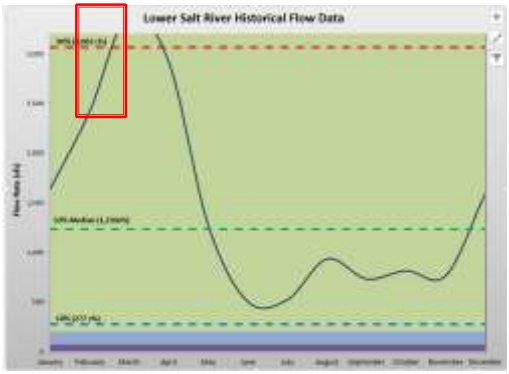
Historical Boating Accounts

- James Stewart (October 1880)
  - Segment 6
  - Superintendent of Stage Company
  - "Will launch his boat on Salt River tonight"

Sources: Arizona Republican 10-2-1920

Historical Boating Accounts

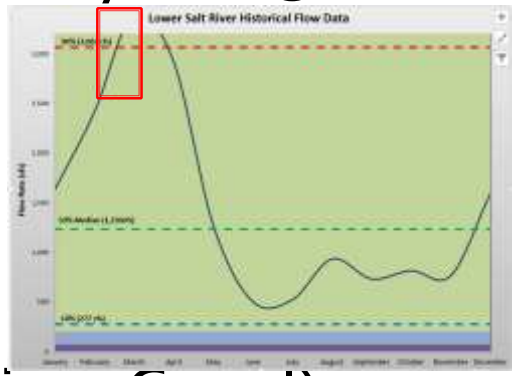
- Cotton & Bingham Trip (February 1881)
  - Phoenix to Yuma (Salt River Segment 6)
  - 18 ft skiff, flat-bottomed
  - Very low draft boat, sturdy
  - Article announces intended launch



AZ Gazette, 2.17.1881

Historical Boating Accounts

- N. Willcox & Dr. G.E. Andrews, February 1883
  - Segment #6
  - Canvas skiff
  - Pleasant except for rain while camping
  - Fort McDowell to Barnum's Pier (Salt River Canal)
    - aka, Swilling's Ditch
  - "Salt River is navigable stream and should be included in the River & Harbor Appropriation Bill"



Sources: AZ Gazette, 2-14-1883

Historical Boating Accounts

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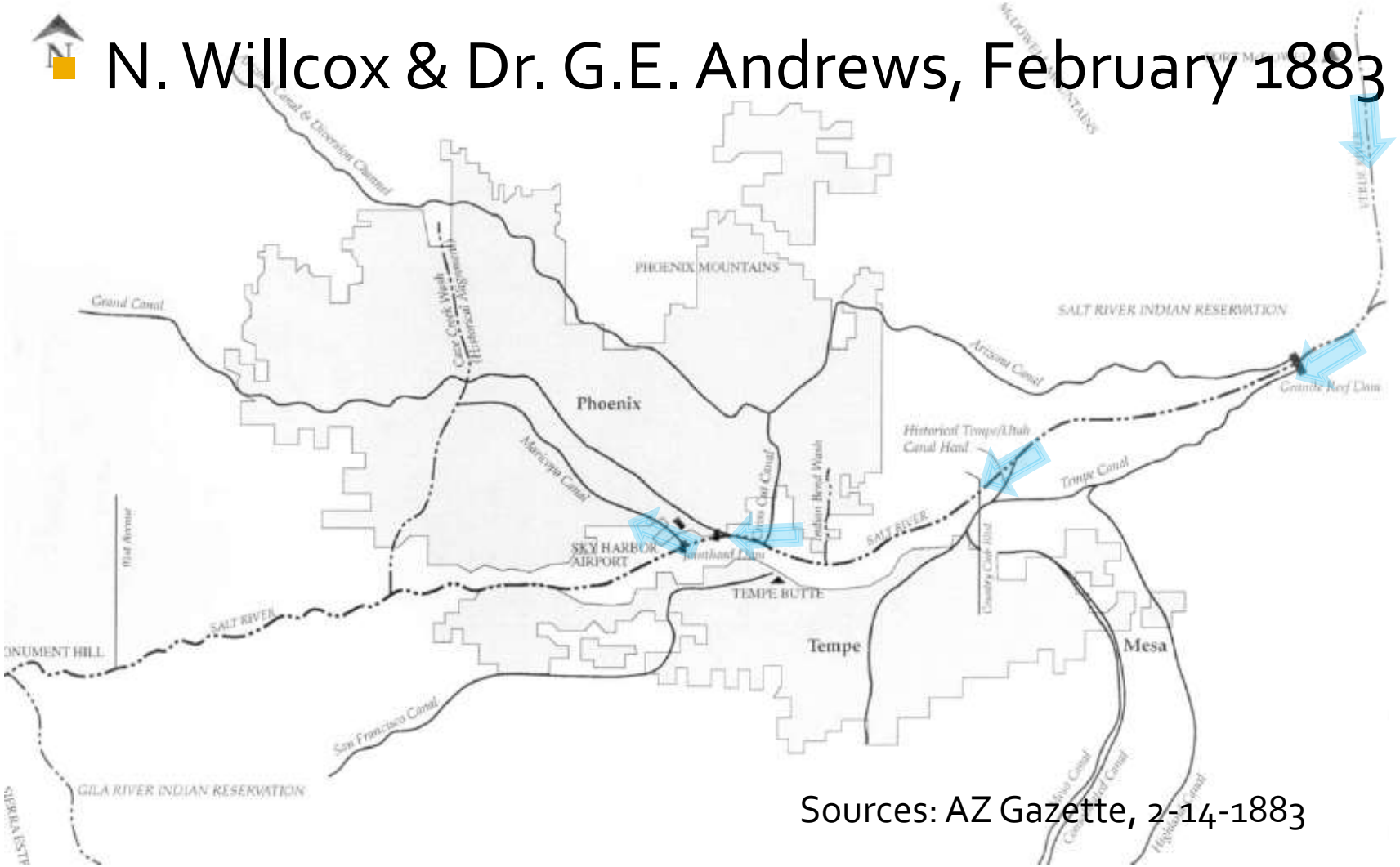
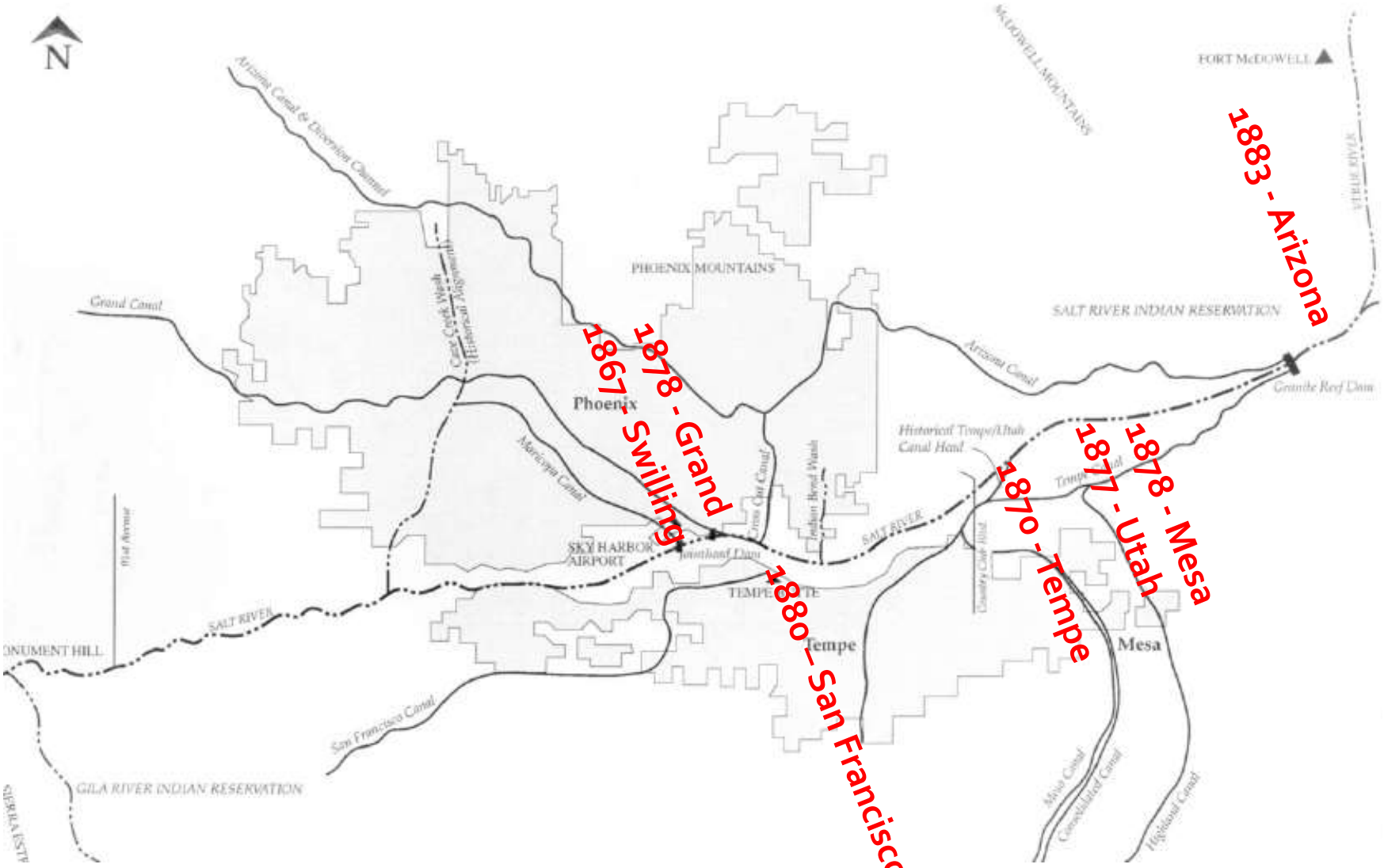


Sources: AZ Gazette, 2-14-1883

Historical Canal Heads: Segment 6

Seg 6



Historical Boating Accounts

- Jim Meadows, 1883
  - Livingston to Tempe (Segment 3-6)
  - Four men, one boat
  - First descent, not reported in papers until 1909
  - "Success"
    - One boater was scared
    - Boat got stuck once on rocks – floated off

Sources: AZ Republican, 10-4-1909

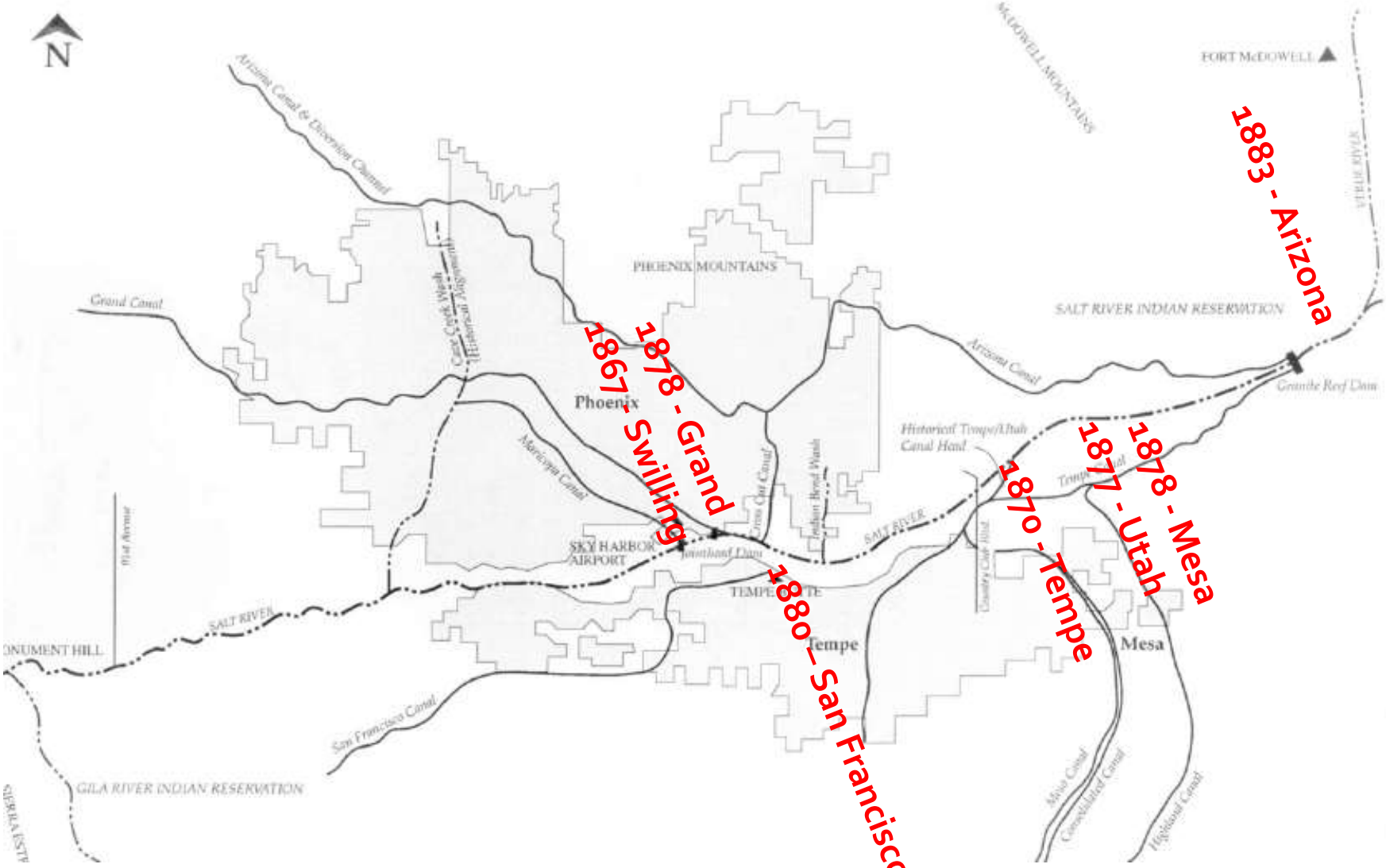
Historical Boating Accounts

- William Burch, June 1885
  - Tonto Creek Confluence to Phoenix (Segments 3-6)
    - Began @ Judge Eddy's Ranch, 4 mi. above Tonto Creek mouth
    - Purpose: Determine if log floating was feasible
  - 18x5 flatboat – 4 or 5 men
  - Hazards:
    - "Numerous projecting boulders"
    - Upset the boat once, lost some gear
  - Success
    - "Undisputed conclusion" that logs can be floated
    - "Exciting & interesting trip"
    - Main difficulty is getting logs to the river (10 mi. from banks)
  - Stream: "6-20 ft. deep"

Sources: AZ Gazette, 6-3,5,6,8-1885

Historical Canal Heads: Segment 6

Seg 6



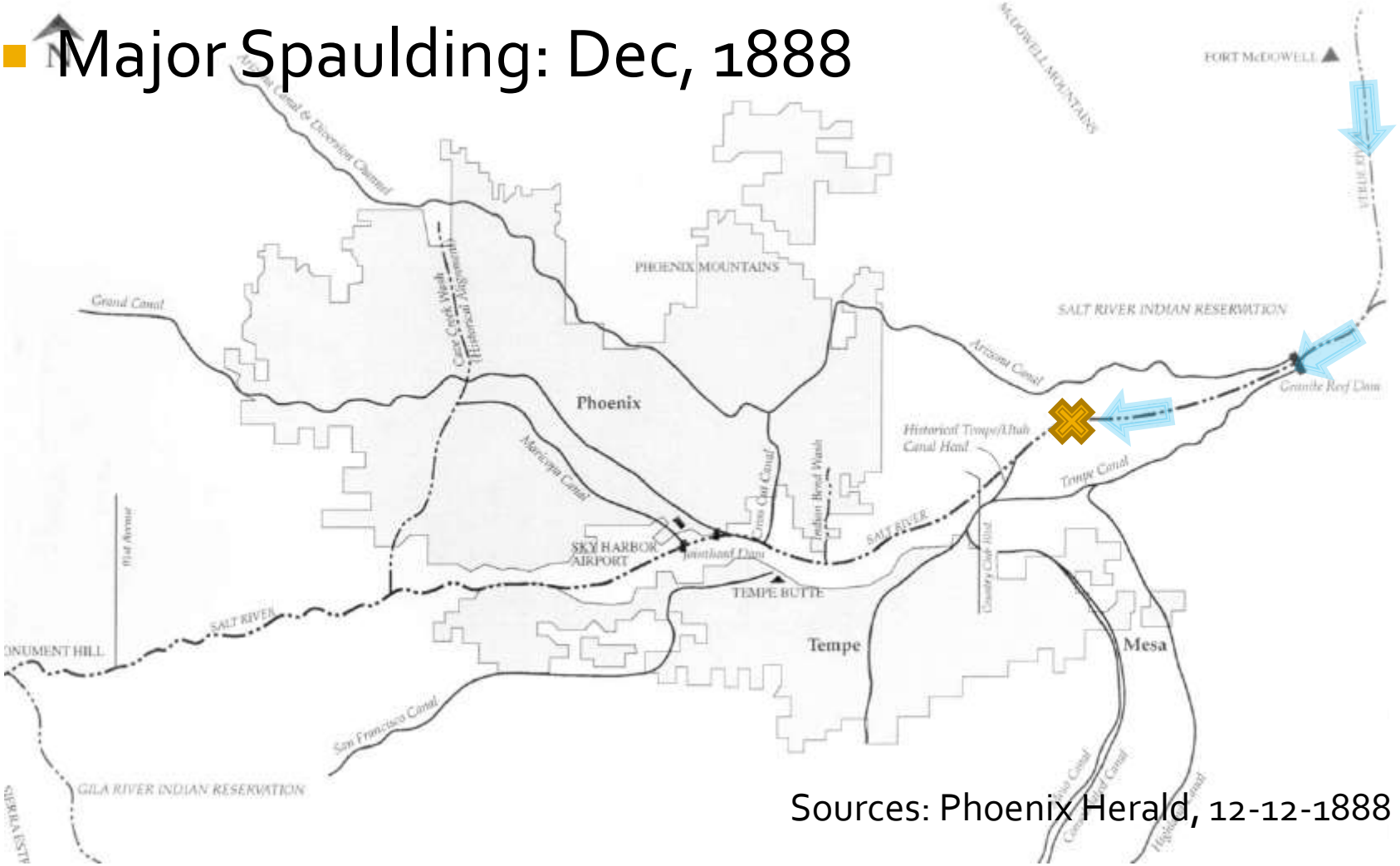
Historical Boating Accounts

- Major E.J. Spaulding, December 1888
  - Ft. McDowell to Mesa Dam (Segment #6)
  - Canoe – 2 men (Capt. Hatfield)
  - Major Spaulding killed by accidental gun fire during portage over dam
  - No boating problems reported

Sources: Phoenix Herald, 12-12-1888

Historical Boating Accounts

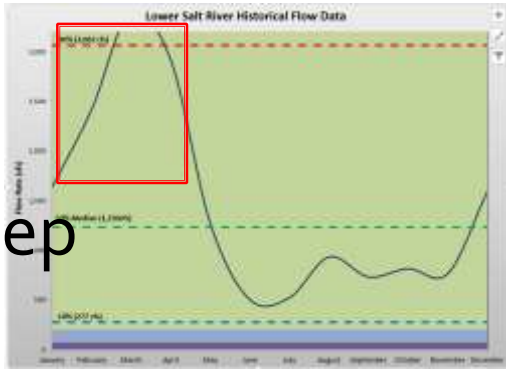
- Major Spaulding: Dec, 1888



Sources: Phoenix Herald, 12-12-1888

Historical Boating Accounts

- Stanley Sykes & Charlie McLean (Winter, 1890's)
  - Segment 6 (Phoenix to Yuma)
  - Canvas over wood frame, painted
  - Salt River at put in: 15-20 ft wide, 1 ft deep
  - Dry reaches until the Gila Confluence
    - Walked beside loaded boat in depleted flow areas
    - River 20 feet wide & 1-2 ft deep.
  - Flow depleted due to irrigation diversions
  - Story recounted ~50 years after the fact



Source: Coconino Sun, 9.7.1945

Historical Boating Accounts

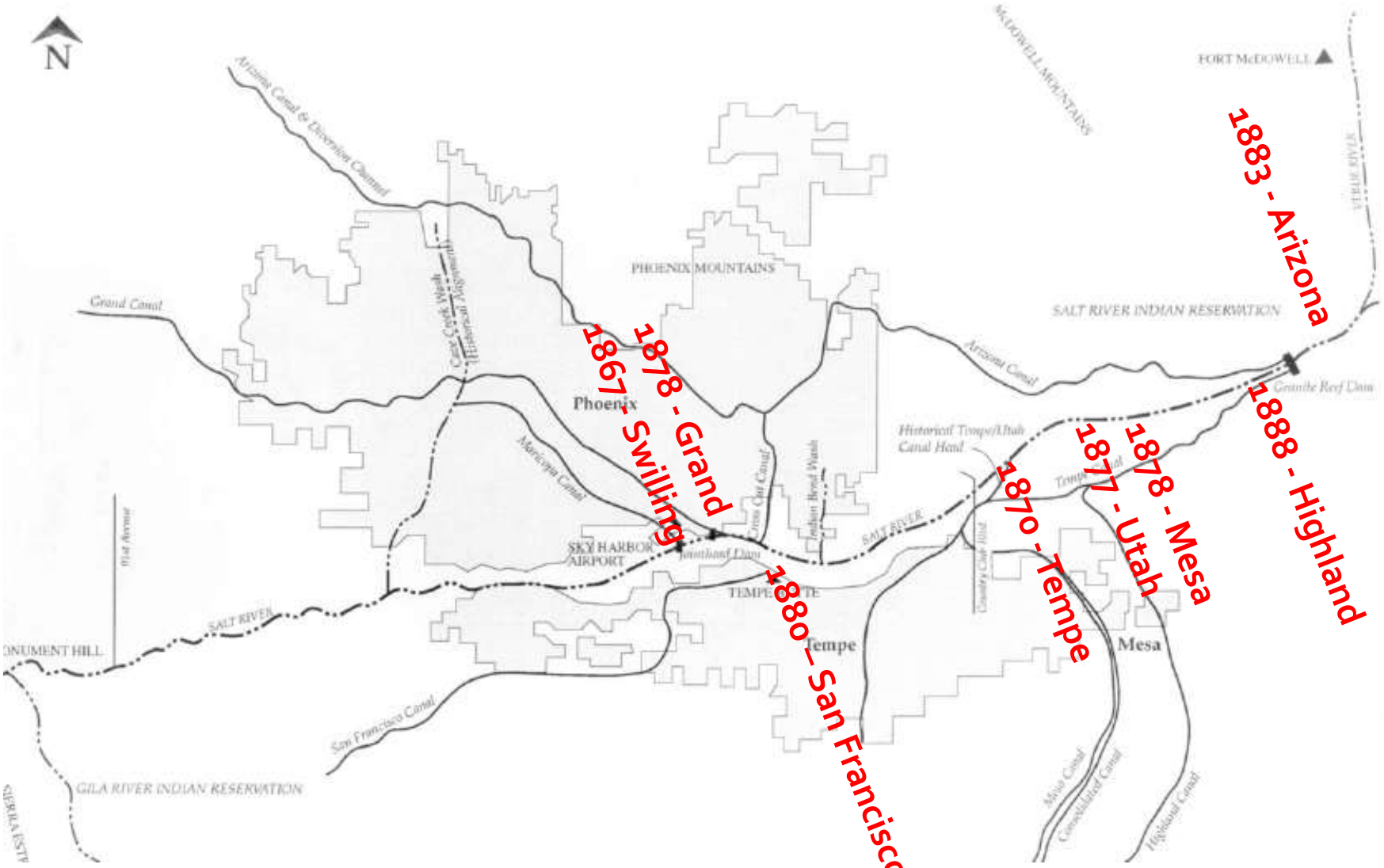
- JK & George Day: Camp Verde to Yuma (1892)
  - Segment 6
  - Small boat
  - September to April
  - Trapping – "large quantity of furs"
  - 5th trip
  - Returned to Prescott by railroad
  - Plan to repeat trip next September

Note: Previous trips not in newspapers

Sources: Arizona Sentinel 4-2-1892

Historical Canal Heads: Segment 6

Seg 6



Rebuttal of Opponent's Economic Analyses

- Mr. Gookin Concluded:
  - Cost of Canoes too high for one-way travel
- Dr. Newell Concluded:
  - Small boats not used for commercial purposes in 1912
  - Canoes were commercially viable boat prior to 1850
- Incorrect standard of navigability:
  - Upstream travel required
  - Boat type limited to large load boats
  - Required repeated, actual historical use
  - Ignored susceptibility argument or re-framed it as actual historical use

Rebuttal of Opponent's Economic Analyses

- Mr. Gookin Costs:
  - Cost of Canoe: $1,282 in 2015 dollars
    - Includes cost of shipping from Sears (43% of amount shown)
  - Neglects Value of Load
    - Beaver (1894): $8-20/pelt 2 x cost of homemade boat
    - $192-$479/pelt (2015 dollars)
  - Also Neglects:
    - Cost of homemade boat (Hamilton Account: $10 >> $239)
    - Value of selling boat at end of trip: Net Zero or Profit
    - Cost to send boat home ($250/tn): $12.50 >> $299

Rebuttal of Opponent's Economic Analyses

- Reality
  - Day Brothers Repeated at Least Five Times
    - Intended to continue
  - Other Trappers in Arizona
    - New Account for Salt (1894), Fogel & Gireaux (1931; Verde)
  - Early Trappers Did Not Live in Arizona
    - Based in Taos, NM fur market.

Historical Boating Accounts

- Hudson Reservoir & Irrigation Co (May/June 1893)
  - Segment 4 – "Salt River Through Canyon"
  - Canvas boats
  - Boats used in commercial survey of river bed
    - "One of the boats"
  - Boat flipped
    - Occupants thrown into river
    - Two boat ribs damaged, boat nearly unserviceable
    - Difficult to find camping spot due to steep, narrow canyon

Sources: Arizona Republican 6-2-1893

Historical Boating Accounts

- Lieutenant Robinson (1893)
  - Segment 6
  - Salt River by boat
    - Phoenix to Yuma
    - Three soldiers, in boat(s)
  - Article recalls a previous trip
  - No details re. boat type or events during trip
    - Boated safely to Yuma & beyond

Sources: Bisbee Daily Review 10-6-1909

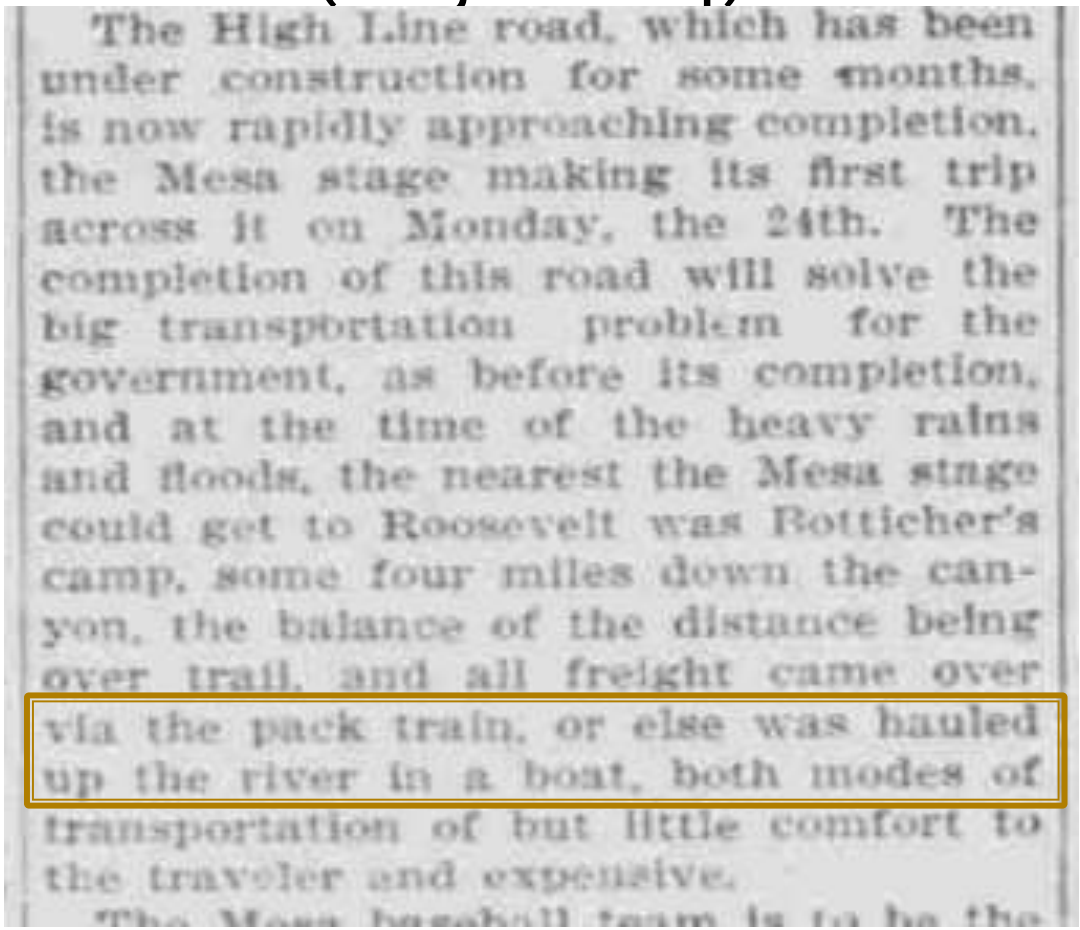
Historical Boating Accounts

- Adams & Evans (Jan 20-Feb 17 1895)
  - Segment 6
  - 18 x 3.5 ft homemade wooden flat boat with cabin
  - Clifton to Sacaton (Gila River)
  - Tempe to Yuma (Segment 6 of Salt River)
  - Hauled the boat from Sacaton to Phoenix
    - Visited for several days in Phoenix
  - Boated Phoenix to Yuma
  - Jan-Feb is beginning of high water season.
    - No records of unusually high flows in Feb 1895

Sources: Phoenix Herald (2.18,25.1895), AZ Sentinel (3.9.1895), AZ Daily Herald (2.18.1895)

Historical Boating Accounts

- Hauling Freight to Roosevelt (Segment 4)
  - "hauled up river in a boat"
  - 4 miles up canyon
  - Botticher's Camp to Roosevelt
  - When road washed out.



The High Line road, which has been under construction for some months, is now rapidly approaching completion, the Mesa stage making its first trip across it on Monday, the 24th. The completion of this road will solve the big transportation problem for the government, as before its completion, and at the time of the heavy rains and floods, the nearest the Mesa stage could get to Roosevelt was Botticher's camp, some four miles down the canyon, the balance of the distance being over trail, and all freight came over via the pack train, or else was hauled up the river in a boat, both modes of transportation of but little comfort to the traveler and expensive.

Sources: AZ Republican, April 30, 1905

Historical Boating Accounts

- Thorpe & Crawford, June 1910
  - Roosevelt Dam to Granite Reef Dam (Segment 4-6)
  - "Ordinary" Rowboat
    - Boat bottom damaged by rocks (June low water trip)
    - Dragged boat "many times"
    - Well pleased with the trip
    - Not a fast trip
    - Couldn't compete with the stage line
  - Below average flow (145 cfs @ McDowell)
    - Less than 10% flow duration

Sources: AZ Republican, 6-28-1910

Historical Boating Accounts

- Herbert Ensign & Donald Scott (May/June, 1919)
  - Segments 4-6: Roosevelt Dam to Phoenix
    - Granite Reef to Phoenix on Arizona Canal
  - Canoe
    - Built extra strong, but light for easy transport around rapids
  - Good Trip Description
    - Flipped in rapid early on Day 1, no gear lost (strapped in)
      - Flipped again. After that, portaged some rapids
    - Few pictures because both paddlers needed to control boat
    - Flipped in Arizona Canal, lost some gear not strapped in

Sources: Arizona Republican 6-28-1919

New Accounts

- Logan (Prior to June 1873) Seg 1-6
  - Littlefield, 2015 (p. 18), citing ASLD Item 10:
    - "…find a way to float logs to Hayden's Ferry via the White and Salt rivers; **this route had been previously navigated by Logan**, a Scottish carpenter, who determined **this was certainly possible**."
  - Hand-built boat
  - White & Salt Rivers – Ft. Apache to Tempe
  - Boated in Spring runoff
  - Very little timber near Salt River Canyon
  - Logan suggested log trip to Hayden

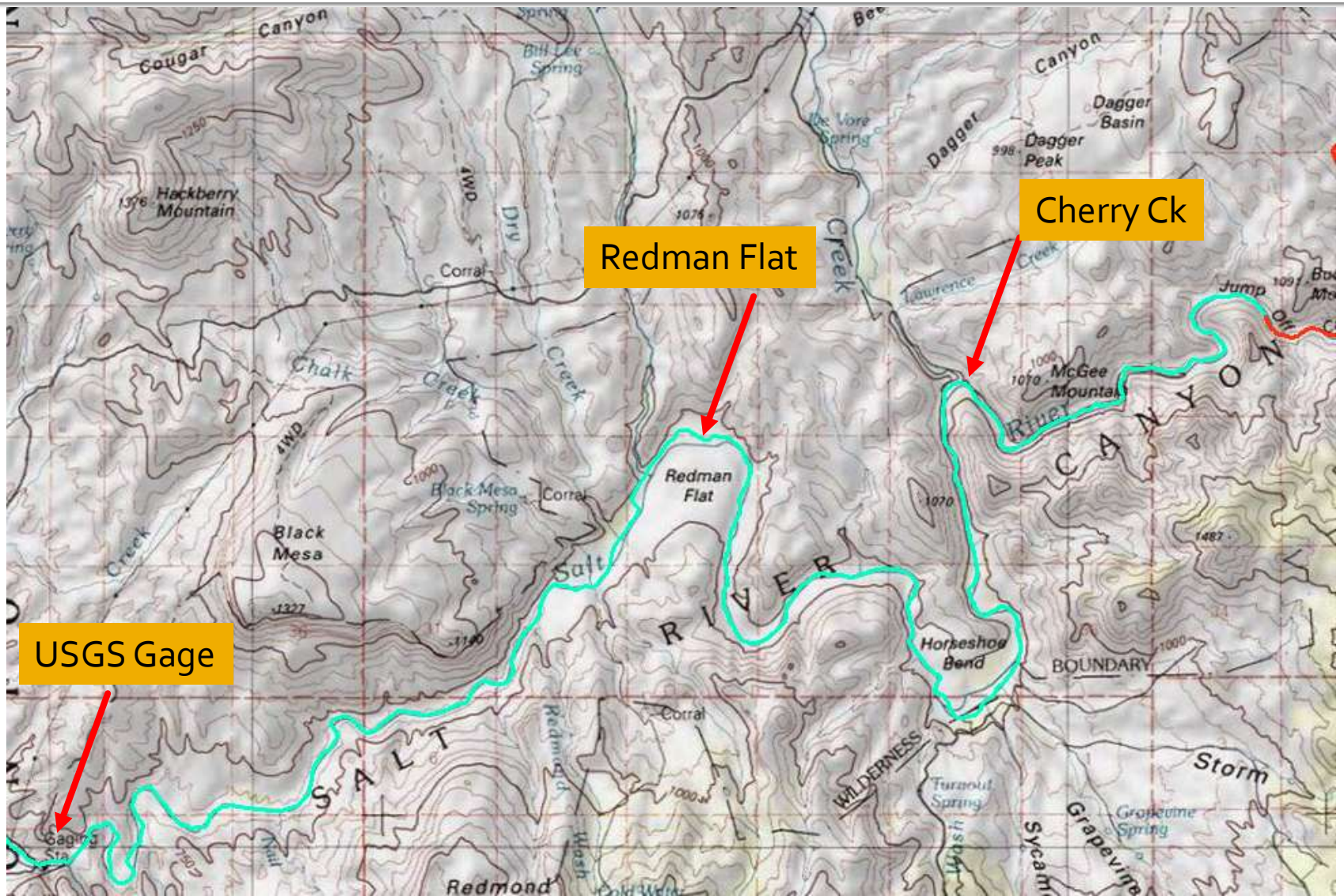
Carl T. Hayden, *Charles Trumbull Hayden Pioneer*, AZ Historical Society, p. 42

Globe Power Company (July 1906)

- Charles Clark/Globe Power Co. Segment 3
- Having a new boat built to replace old boat
- Old boat washed away overnight, July 5
- Boats used in work conducted by engineers
- Reservoirs proposed, tunnel, power plants
- Cherry Creek to Redmon Flat
- USGS Flow Rate (@ Roosevelt):
  - July 5: 765 cfs
  - Week prior: 385 cfs

Source: Arizona Silver Belt, July 12, 1906

Globe Power Co. (July 1906)



Trappers (Jan 1894)

- Two Brothers (Segment 6)
- Building a boat (canoe), almost complete
- Work Salt & Gila Rivers
- Seen 6 miles upstream of Phoenix
- Few weeks ago (January)
- Beaver are plentiful (in 1894)
- Skins worth $8-20 each
- Jan/Feb 1894 Flows = 494-591 cfs

Source: AZ Republican, Feb 11, 1894

Historical Boating Accounts

Summary of Historical Boating Accounts

#	Account	Boat Type	Date	Success?	Segment	Purpose
1	Logan	Wood	< 1873	Yes	1-6	Travel
2	5 Tons of Wheat	Flat boat	April 1873	Yes	6	Commercial
3	Hayden	Canoe, Logs	June 1873	No	1	Commercial
4	Hamilton	Skiff	Jan 1879	Yes	6	Travel
5	Stewart	Boat	Oct 1880	Unknown	6	Boat builder
6	Cotton & Bingham	Skiff	Feb 1881	Unknown	6	Travel
7	Yuma or Bust	Flat boat	Nov 1881	Yes	6	Travel
8	Willcox & Andrews	Canvas Skiff	Feb 1883	Yes	6	Travel

Historical Boating Accounts

Summary of Historical Boating Accounts

#	Account	Boat Type	Date	Success?	Segment	Purpose
9	Meadows	Boat	1883	Yes	3-6	Commercial
10	Burch	Flat boat	June 1885	Yes	3-6	Commercial
11	Spaulding	Canoe	Dec 1888	Yes	6	Travel
12	Sykes	Canvas boat	1890's	Yes	6	Travel
13	JK Day	Boat	Spring '92	Yes	6	Commercial
17	JK Day	Boat	Spring Pre-1892	Yes	6	Commercial 4 trips
18	Hudson Res.Co.	Canvas boat	June 1893	Yes	4	Commercial

Historical Boating Accounts

Summary of Historical Boating Accounts

#	Account	Boat Type	Date	Success?	Segment	Purpose
19	Robinson	Boat	1893	Yes	6	Travel
20	Trappers	Wood	Jan 1894	Yes	6	Commercial, Trapping
21	Adams & Evans	Flat boat	Jan 1895	Yes	6	Travel – Recreation
22	Gentry & Cox	Large Ferry	Jan 1889	Yes (on Salt)	6	Commercial
23	Roosevelt Freight	Boats	April 1905	Yes	4	Commercial
24	Advertise-ment	Boat	May 1905	Unknown	6	Hunting
25	USRS	Boat	Dec 1905	No	6	Travel
26	Shively	Boat	Mar 1905	Yes	6	Travel

Historical Boating Accounts

Summary of Historical Boating Accounts

#	Account	Boat Type	Date	Success?	Segment	Purpose
27	Globe Power Co	Wood	July 1906	Yes	3	Commercial, Survey
28	Rains	Boat	April 1909	Yes	6	Travel
29	Selly	Boat	1909	Unknown	3 or 6?	Boat builder
30	Thorpe & Crawford	Rowboat	June 1910	Yes	3-6	Travel – Recreation
31	Ensign & Scott	Canoe	June 1919	Yes	3-6	Travel - Recreation

Not Counted in Summary:

1. Boats used in construction of dams (Roosevelt, irrigation dams)
2. Boats used during floods
3. Boats used on canals
4. Ferry trips across river (~ commercial ferries, multiple locations, 1,000's(?) of trips)

Historical Accounts: Summary

- Are These Every Historical Trip?
  - 1993 Report: 13 Accounts
  - 2015 Testimony: 28 Accounts
  - 2016 Rebuttal: 31 Accounts
- 9 of 31 were not reported immediately in newspapers.

Historical Accounts: Definition of Success

- Boating Success =
  - Boat, Boater & Cargo arrive at destination
  - No deaths or serious injury due to boating
  - The boaters themselves called it a success
- This is the Standard Generally Used by Boaters

Historical Accounts: "Other Guys" Definition of Failure

- Any Single Account is a Failure (MN)
  - Trip must be repeated regularly (> 5 times; > 1/year)
- Not Carrying a "Commercial" Sized Load
  - 15 Tons (MN)
- Canoes not Commercial After 1850 (MN)
- Boat Flipped (Gkn, DL)
  - Even if boat is righted and trip continues

Historical Accounts: "Other Guys" Definition of Failure

- Boat Damaged (Gkn)
  - Scratched, worn, & repairable are failures
- Boat is Temporarily Stuck (Gkn, DL)
  - Getting stuck in Colorado River apparently is different
- Trip Not Long Enough (Gkn)

- No Adjustment for Depleted River Flow Conditions

Historical Accounts: Summary

- 31 Trips
  - 2 Unsuccessful (only 1 failure in Segment 2-6)
  - 4 Insufficient information (e.g., launch only)
- No Flood Accounts Included
- Canoes, Flatboats, Canvas Boats, Skiffs
- Downstream & Upstream Direction
  - Most trips went downstream only
- No Problems with Beaver Dams Noted
- Rapids Noted (Seg 4 only), Did Not Stop Trips
- Includes Trade & Travel
- Throughout Year (June most frequent)

Modern Boating

Modern Boating - Rebuttal

- What are the Areas of Consensus?
  - Modern Boating Occurs
  - When Modern Boating Occurs
  - Types of Modern Boats Used
- What are the Areas of Disagreement?
  - Are Modern Boats Meaningfully Similar to Historical Boats?
  - Do Modern Boats Allow Boating in Reaches that Could Not be Boated by Historical Boats?

Modern Boating - Rebuttal

- Does Modern Boating Occur?
  - No Disagreement That it Occurs
  - Segment 1: Prevented by Indian Law. Has occurred.
  - Segment 2: Year-round, but most in spring runoff
    - Spring boating limited by USFS permit caps
    - WMAT currently limits boat type (no open canoes)
  - Segment 3: Year-round, but most in spring runoff
    - Spring boating limited by USFS permit caps
  - Segment 4: On reservoirs (not natural condition)
  - Segment 5: Most during reservoir release
  - Segment 6: On effluent & during floods

Modern Boating - Rebuttal

- What Types of Modern Boats Are Commonly Used?
  - No Disagreement on Common Boat Types
    - "Rubber" Rafts (Seg 2-3,5,6)
    - Hard Shell & Inflatable Kayaks (Seg 1-3, 5,6)
    - Hard Shell & Inflatable Canoes (Seg 2-3, 5,6)
    - Segment 5 only: Jet & Air Boats, Row Boats, Tubes, Canoes, Kayaks, Dories, Rafts, Small Motor Boats
    - Segment 4: Under Reservoirs - many boat types on lakes.

Modern Boating - Rebuttal

- Are Modern Boats Meaningfully Similar to Historical Boats?
  - Little consensus on this point
    - Apples to apples comparisons
    - Clean up some errors
    - Qualified experts
  - Review of "Meaningfully Similar"
    - Does not mean exactly the same or without difference
    - Does mean: Can you boat now where you could not then?
    - "Similar" does not mean "Same"

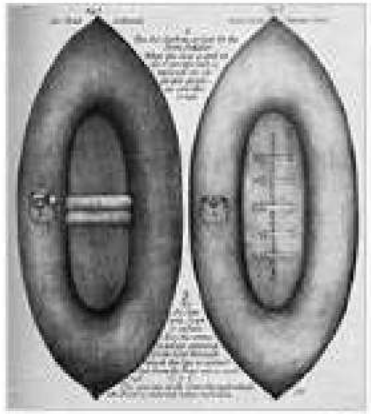
Modern Boating - Rebuttal

- Meaningfully Similar – Comparison of Historical and Modern Boats of Similar Type
  - Purpose: carry people & load — No change
  - Design: performance improvements — No change
  - Weight: depends on material — No change
  - Durability: depends on materials — Some change
  - Draw: function of load — No change
  - Load: gravitational pull the same — No change

Modern Boating - Rebuttal

- Design: performance improvements, but similar design

Modern Recreational Boating



A two-man Halkett boat, with and without its canvas cover

113

Modern Recreational Boating

- Meaningfully Similar to Historical Boats?

A. B. N. Morris wood-and-canvas canoe built approximately 1912

2014 Old Town Wood Canoes

110

Modern Recreational Boating

- Meaningfully Similar to Historical Boats?

Kolbs in "Edith" in 1911
Replica boating in the Edith in 2013

111

Modern Boating Rebuttal: Comparison Error by Gookin (Slide 111)

- Gookin Slide 111

- Compares wood & canvas rigid canoe to folding canvas rowboat with metal frame. These are two different boat types, with different uses and purposes.

Modern Canvas Canoe — Source: Old Town Canoe

Old Canvas Canoe — Source: Fuller 2015a: Slide 143

Modern Boating Rebuttal: Historical Canoes NOT Heavier

Boat	Historical	Modern
Birch Bark		
• 14 ft	50lbs (www.barkcanoe.com)	50lbs (www.barkcanoe.com)
• 15 ft	50lbs (www.barkcanoe.com)	50lbs (www.barkcanoe.com)
Wooden Canoe		
14 ft (EM White)	55lbs (wooden-canoes.com)	
15 ft (BN Morris)	60lbs (wooden-canoes.com)	
16 ft (Old Town Guide)		76lbs (www.oldtowncanoe.com)
Wood & Canvas (Rigid)		
17 ft (BN Morris)	75lbs (wooden-canoes.com)	
16 ft (Old Town Guide)		76lbs (www.oldtowncanoe.com)
Canvas (Folding)		
12 ft (Canvas Boat Co., 1908)	55lbs (ASLD 32)	
15 ft (Pakboats 150)		45lbs (pakboats.com)
Plastic		
16 ft (Wenonah Rogue)		69lbs (www.canoekayak.com)
Kevlar Ultra-light		
16 ft (Wenonah Aurora)		39lbs (www.wenonah.com)
Aluminum		
15 ft (Grumman/Marathon)		69lbs (www.marathonboat.com)
17 ft (Pro Strike)		72lbs (www.directboats.com)

Note: SRP Expert Newell suggests boat weight might make 0.5-1 inch difference in draft.

Modern Boating Rebuttal: Some Modern Canoes Are More Durable

- Correction: ***Some*** modern canoes are more durable than ***some*** historical canoes
  - Plastics generally more durable than wood & canvas.
  - Modern wood and canvas have about the same on-the-water durability to historical wood and canvas.
  - Most Kevlar boats are lightweight but not durable.
  - Fiberglass boats are not known for durability. Rarely used today except on flat water.
  - Aluminum boats are vulnerable to denting. Rarely used today except on flat water.
  - Durability is a non-issue in Segments 5 & 6
  - Historical boats were sufficiently durable for the Salt River

Durability of Historical Boats on Shallow Rocky Rivers

Going downstream is called snubbing, in birch bark canoe

Keewaydin Photo Archives

Durability of Historical Boats on Shallow Rocky Rivers

In cedar canvas canoe, going upstream
From Paddlemaking blogspot

Paul J. Fournier poles his canoe up Allagash Stream in Maine

Segment 5: 2015 Edith Voyage
Wood & canvas replica boats

Edith on Grand Canyon above Salt River Segment 5 at left

Historical wood and canvas boats can be used on a wide variety of rivers, shallow & rocky – or large & fast.

Modern Boating Rebuttal: Historical Boats were NOT "Fragile"

- Many modern boat materials more durable
- Does not mean all historical boats had NO durability or were fragile
- Dimock: Old growth wood more durable.
- Historical boats used on shallow, rocky rivers
- Historical boats used on Salt River, Verde River, Gila River; other rivers throughout the western USA
- Boat designs were adapted for specific river characteristics

Modern Boating Rebuttal: Boat Crashes ≠ Non-Navigable

- EG: Gookin, Slide 108-9
  - Citing USFS Report
  - Note: USFS advocates against navigability

Fiberglass Canoes Figure IV-1 Source: USDA

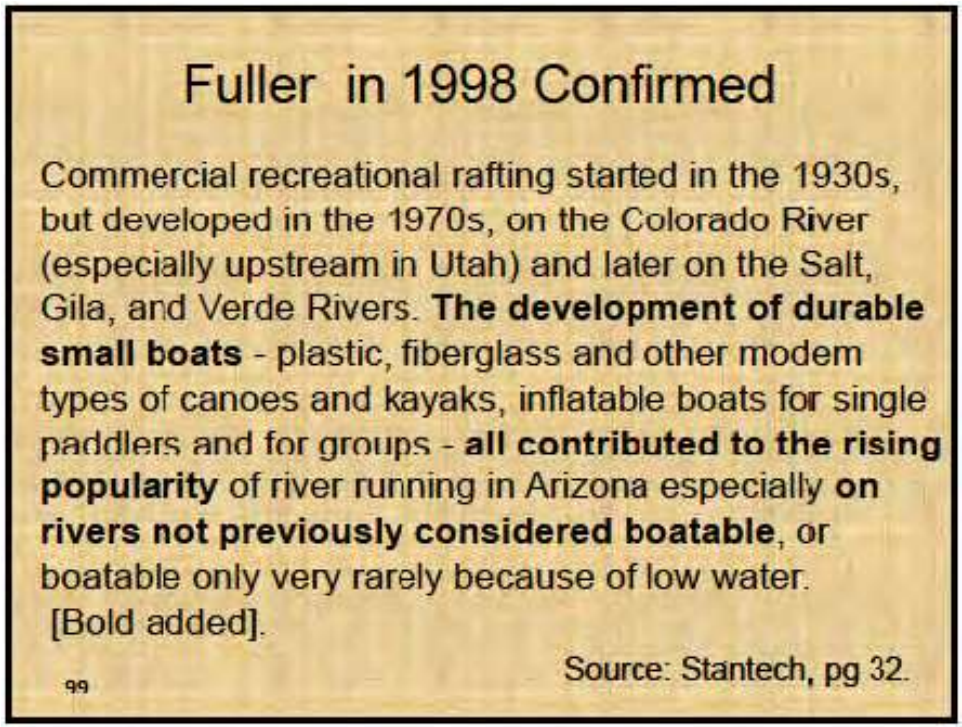
Modern Boating Rebuttal: Boat Crashes ≠ Non-Navigable

- If so, the Mississippi River is NOT navigable.

No. The occurrence of boat accidents is not part of the federal navigability test.

Modern Boating Rebuttal: Gookin – Slide 99

- Stantech ≠ Fuller
- Report for ANSAC, not ASLD
- Not Directly Applicable to Salt River
- Repeated this Error More than 30 times
- Not directly applicable to Salt River – already considered boatable



Meaningfully Similar

- Load & Draw
  - Most of boat's weight is in load, not boat materials
  - Load capacity is function of boat design
  - Basic design not changed significantly
- Draw is a function of
  - Load carried
  - Displacement
  - Design of boat (length, width, section, depth)
  - Placement of load within boat

Draw vs. Operating Depth

- HYRA standard considers operating condition
- Boatman's viewpoint
- Factors:
  - Boat length – plunging significant for long boats
  - Boat design – rocker, rigidity, flare, decking
  - Boat maneuverability
  - Boat load – how and how much
  - Slope of rapid
  - Flow velocity
- Operating Draw ≠ Boat Design Factors
- Geomorphology of Pool & Riffle Streams
- Plunging Not a Factor on Salt River for Small Boats

Modern Boating - Rebuttal

- Do Modern Boats Allow Boating in Segments that Could Not be Boated by Historical Boats?
  - No.
    - What segments of the Salt did people boat then? 1-6
    - What kinds of boats did they use? Small, low draft
    - What times of year did they boat? All year
  - Summary:
    - Historical boats were used then & now
    - Modern boat materials make it easier to boat rocky rivers.
    - Less boating & repair skills needed today.
    - But the same reaches are boated today as then in similar boats

Modern Boating - Rebuttal

- What Can We Learn From Modern Boating?
  - What the river looks like
  - River depths & widths
  - Low & high water boating conditions
  - The nature of "obstacles" like:
    - Rapids and riffles
    - Sand bars
    - "Braiding"
    - Beaver Dams

Modern Boating vs. Historical Boats

Salt River Hydrology

- What are the Right Flow Rates for the Salt River?
  - Average?
  - Median?
  - Seasonal?
  - Monthly?
  - Daily?
  - USGS Published Values?
  - USGS Raw Data?
  - Reconstructed Values?

Salt River Hydrology

"Lies, Damned Lies & Statistics"

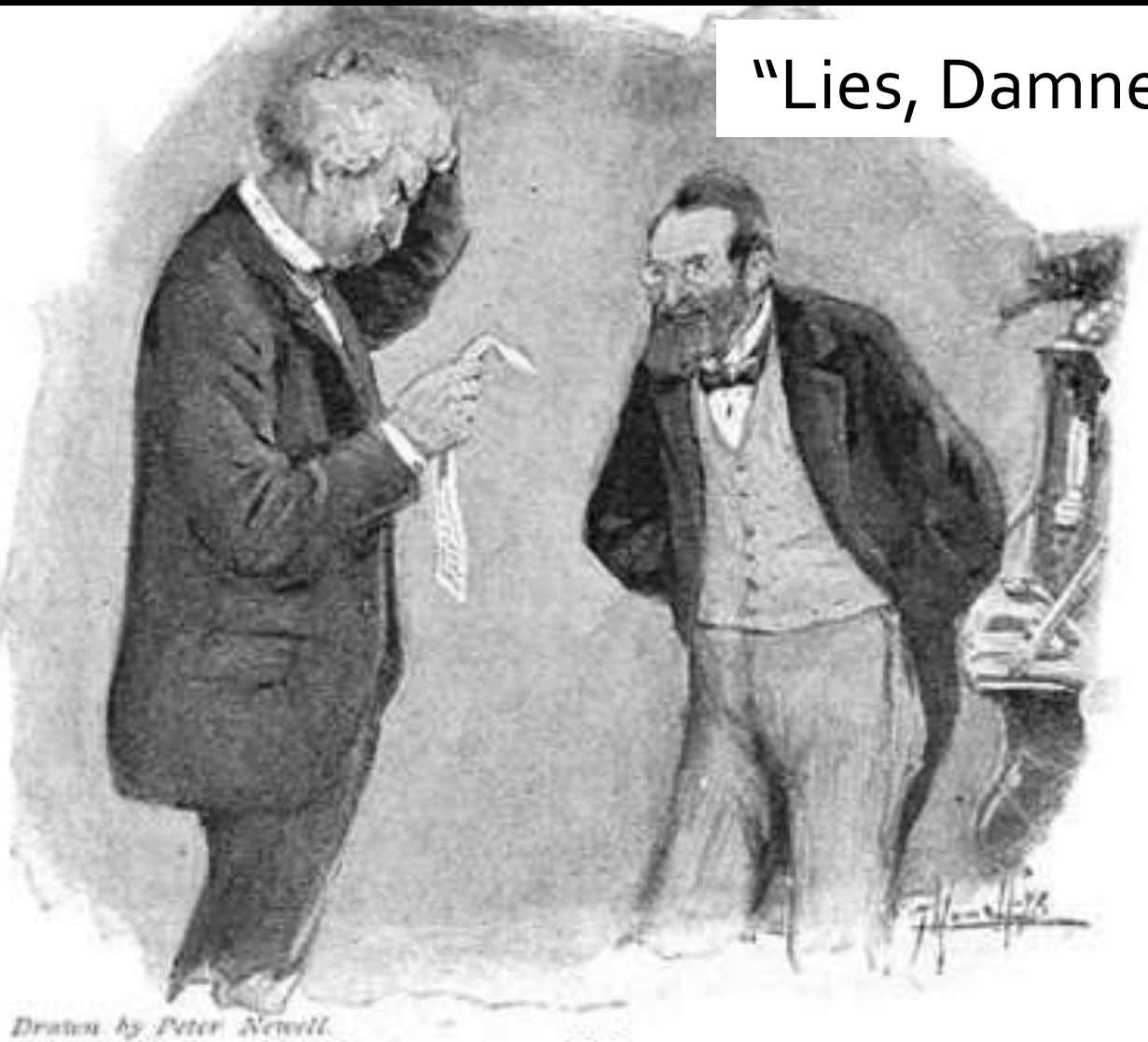


Illustration by Peter Newell from COSMOPOLITAN, August 1898

Figures often beguile me, particularly when I have the arranging of them myself; in which case the remark attributed to Disraeli would often apply with justice and force: "There are three kinds of lies: lies, damned lies and statistics."

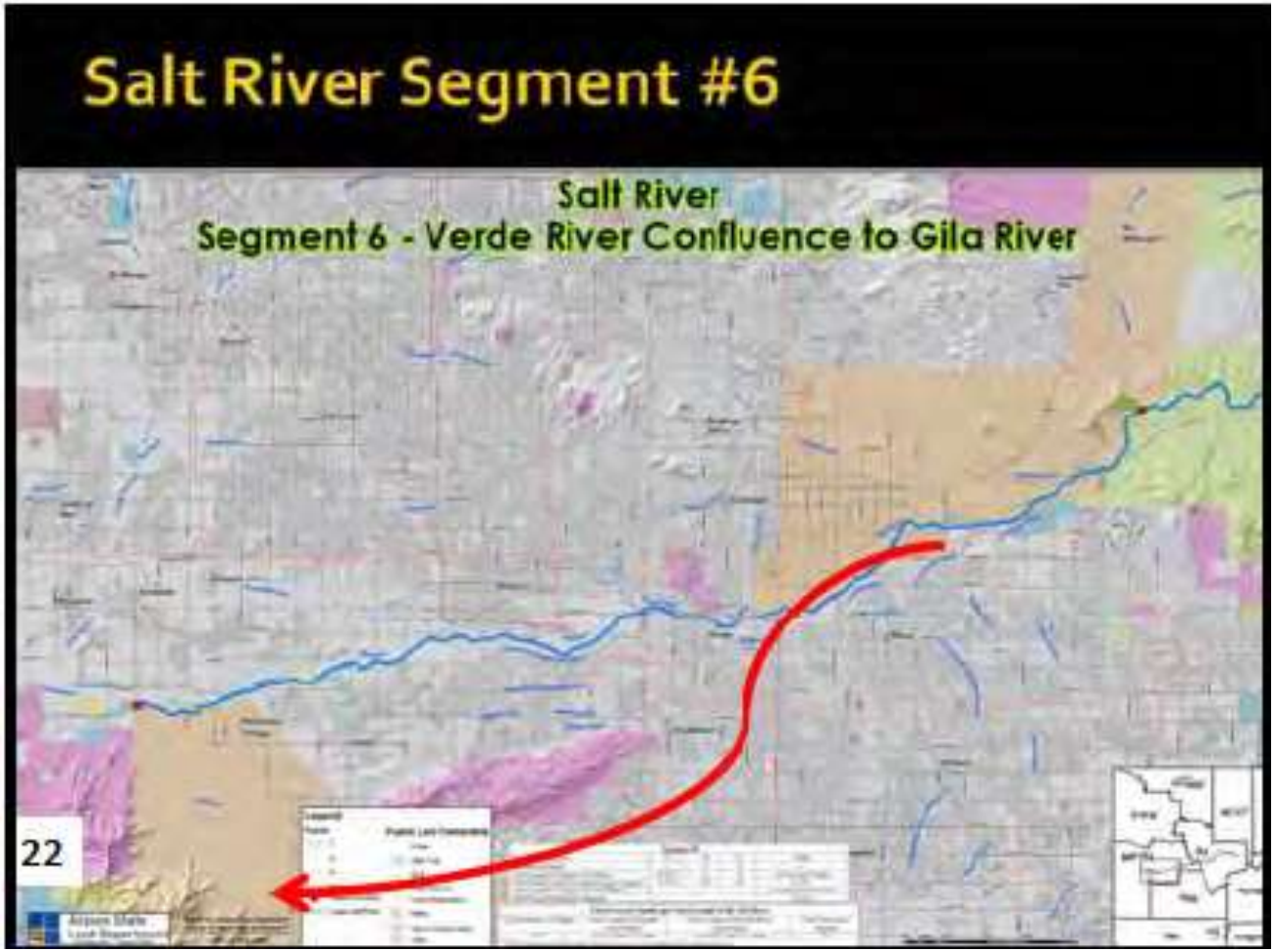
- Mark Twain's Own Autobiography: The Chapters from the North American Review

Salt River Hydrology: Miscellaneous Rebuttal Items

- The upper watershed does not produce all the runoff.
- The Salt River is not erratic and unpredictable
- There is no evidence that the Salt River ordinarily dried up.
- "Base Flow" does not mean only the water that rises out of the subsurface at one point.
- Seasonal high flow ≠ flood.
- Mr. Burtell's flow reconstructions may not be conservative upper limit estimates.
- No evidence that Salt River loses 200 cfs between Tempe Butte and Gila River confluence

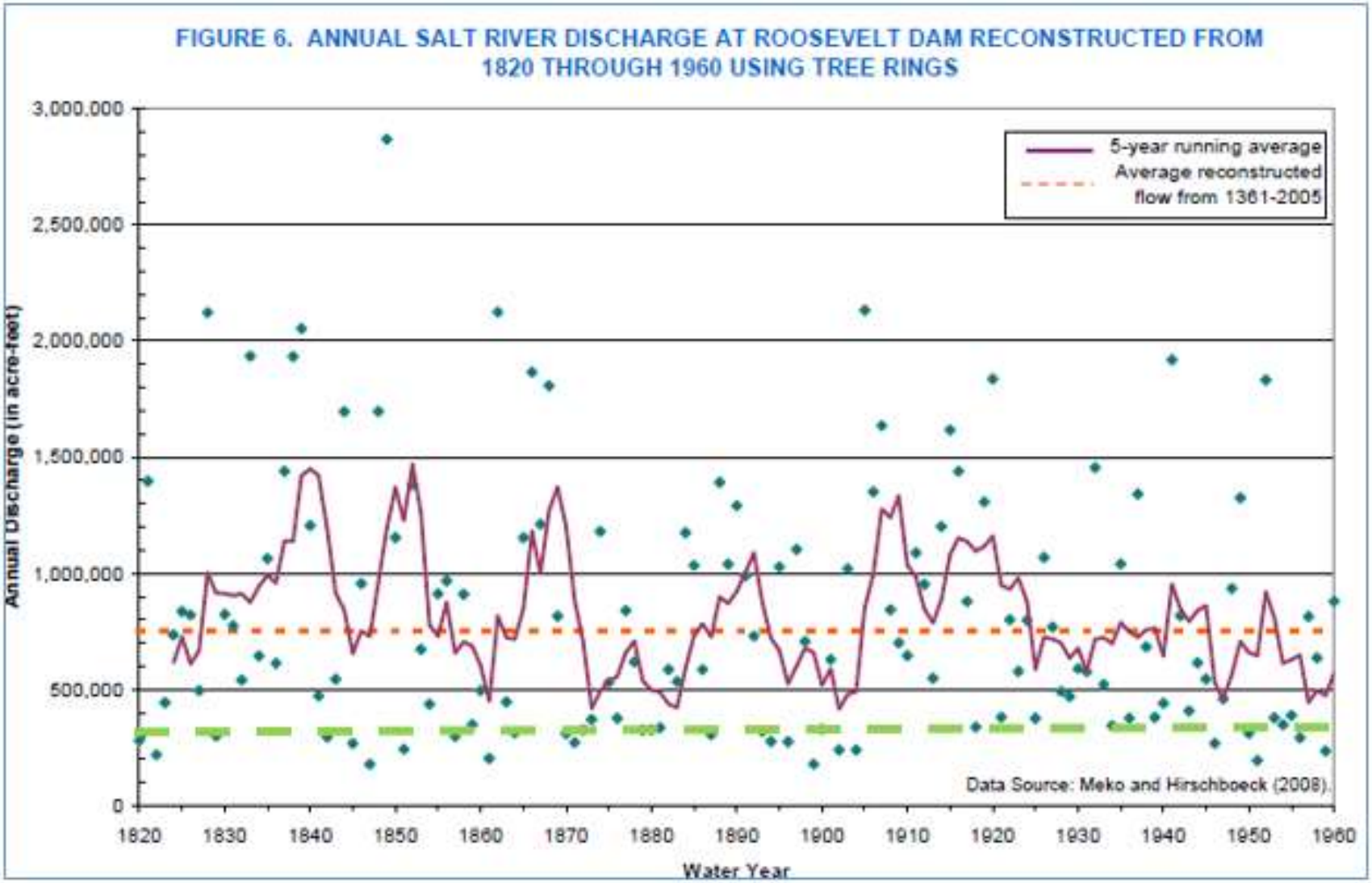
Miscellaneous Corrections

- Gookin: Slide 22 – 200 cfs lost to ancient channel

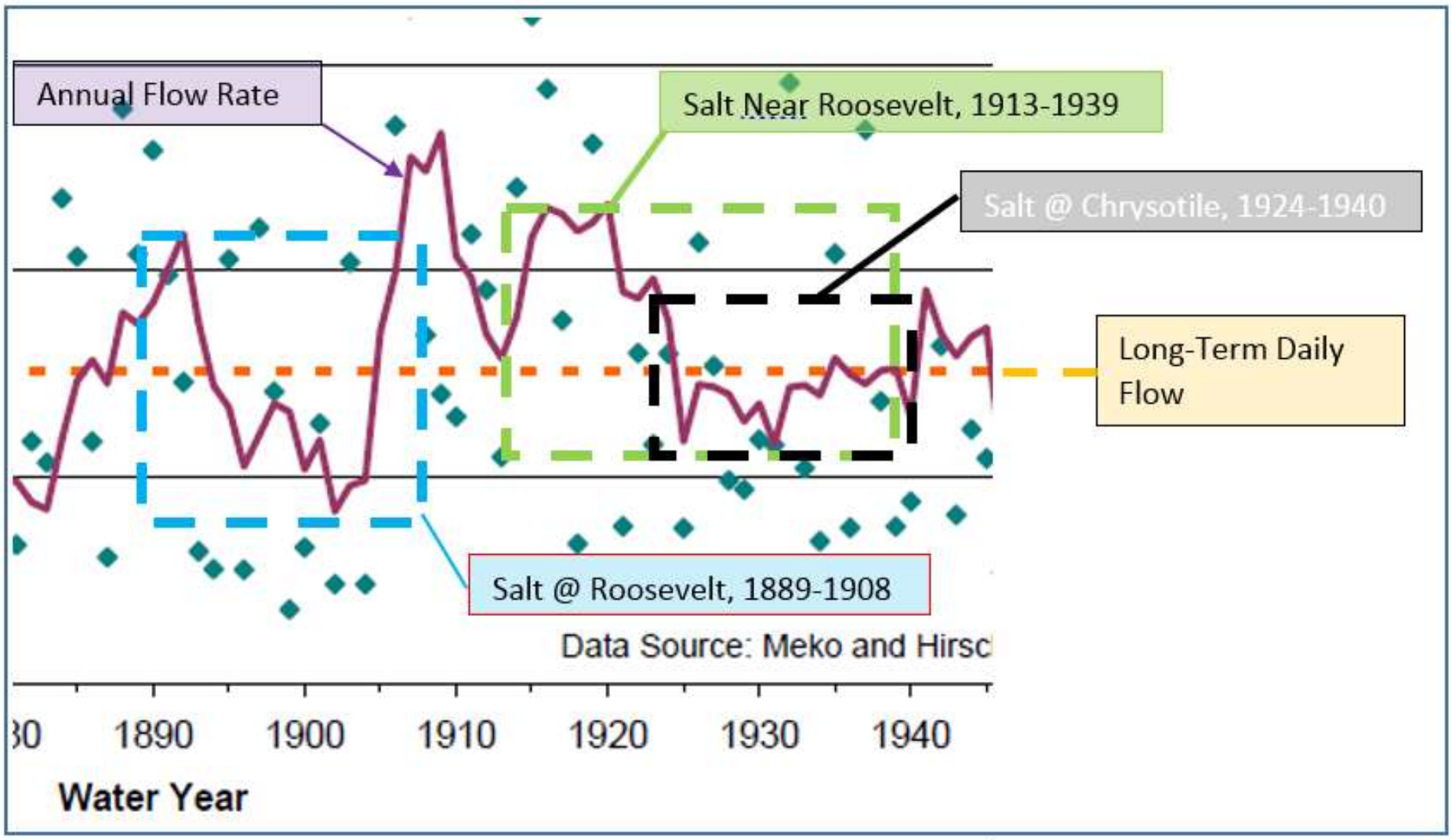


There is no evidence for Mr. Gookin's theory.

Salt River Hydrology: Miscellaneous Rebuttal Items



Salt River Hydrology: Miscellaneous Rebuttal Items



Salt River Hydrology: Areas of Consensus

- The Salt River is Perennial
- There are Ordinary Seasonal Fluctuations
- Flow Rates Increase with Drainage Area
  - Some loss in Segment 6
- The Salt River has a Larger Flow Volume than the Gila River at their Confluence
- USGS Flow Data are the Best Available
- Human Impacts Have Depleted Flow
  - Natural condition had higher flow rates

Salt River Hydrology: Recommended Flow Rates

- Segments 1-5
  - Use USGS Stream Gauge Data – full period of record
    - Segment 1: Sum of White River (#9490500; 1959-2015) and Black River (#9494000; 1958-2015).
    - Segment 2: Salt River near Chrysotile (#9497500;1925-2015)
    - Segment 3: Salt River near Roosevelt (#9498500;1914-2015)
    - Segment 4: Sum of Salt River near Roosevelt and Tonto Creek above Gun Creek (#9499000;1942-2015)
    - Segment 5: Add Salt River near Roosevelt and Tonto Creek above Gun Creek (same as Segment 4)
  - Addition of ~20 years of record, primarily below average flows lower discharge estimates.

Salt River Hydrology: Recommended Flow Rates

- Segments 1-5
  - Use Rich Burtell's Flow Depletion Estimates
    - Segment 1: 0 cfs
    - Segment 2: 31 cfs (Chrysotile)
    - Segment 3-5: 68 cfs (Roosevelt)
    - Adjustment not applied to mean & median annual estimates
  - 2-Year Discharge Estimate Published by USGS
    - Segment 1 estimate from Black River gage (not White River)
    - Segment 6 estimate from ASLD report

Salt River Hydrology: Recommended Flow Rates

- Segments 1-5
  - Range of Ordinary Flow
    - Low End: 10% flow duration based on daily data
    - High End: 2-Year Discharge Estimate Published by USGS
      - Segment 1 estimate from Black River gage (not White River)
      - Bankfull Discharge
      - Ordinary High Water Mark
  - Includes normal seasonal fluctuations
    - Use of full record of USGS daily discharge estimates to determine median flow by calendar day.

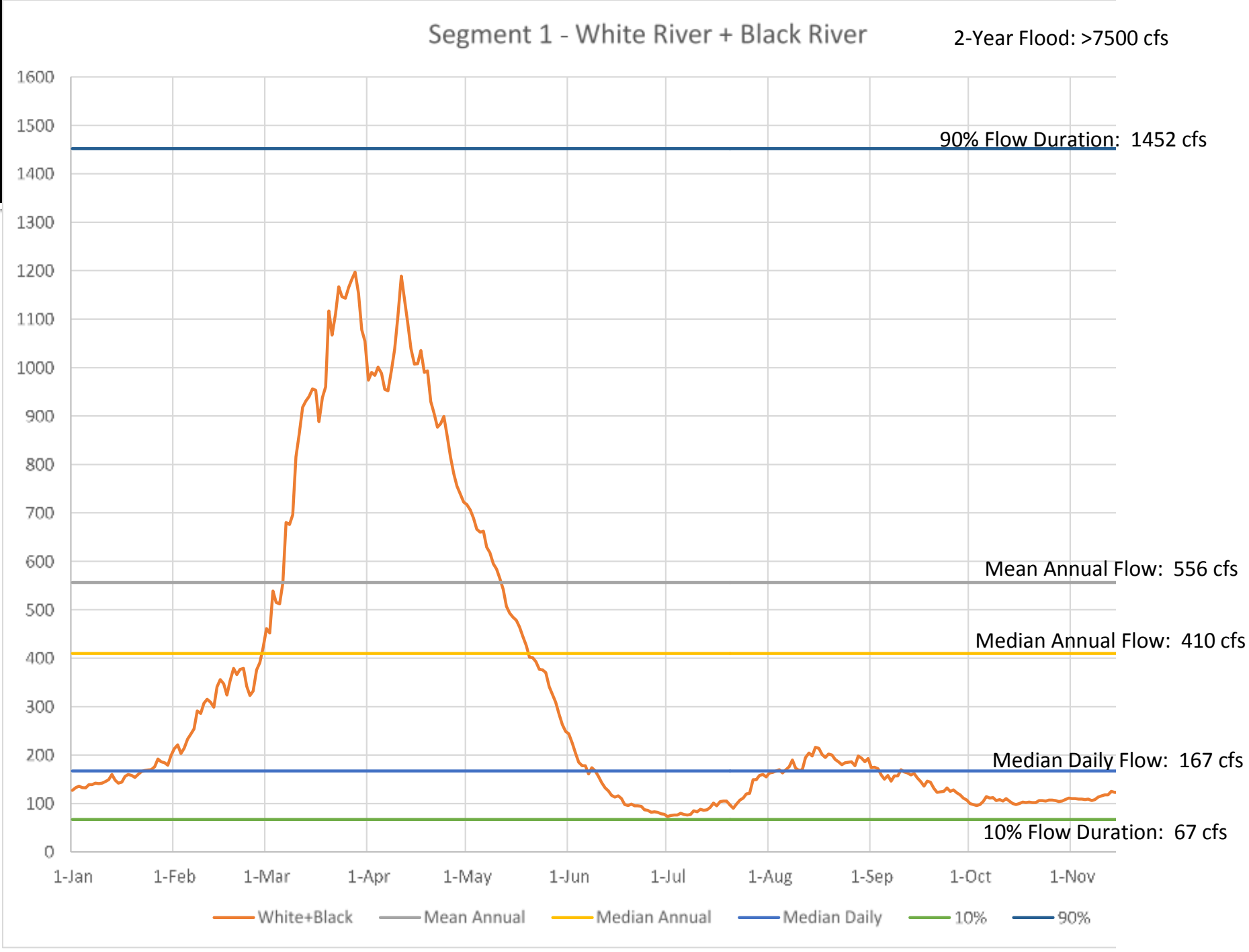
Salt River Hydrology: Recommended Flow Rates

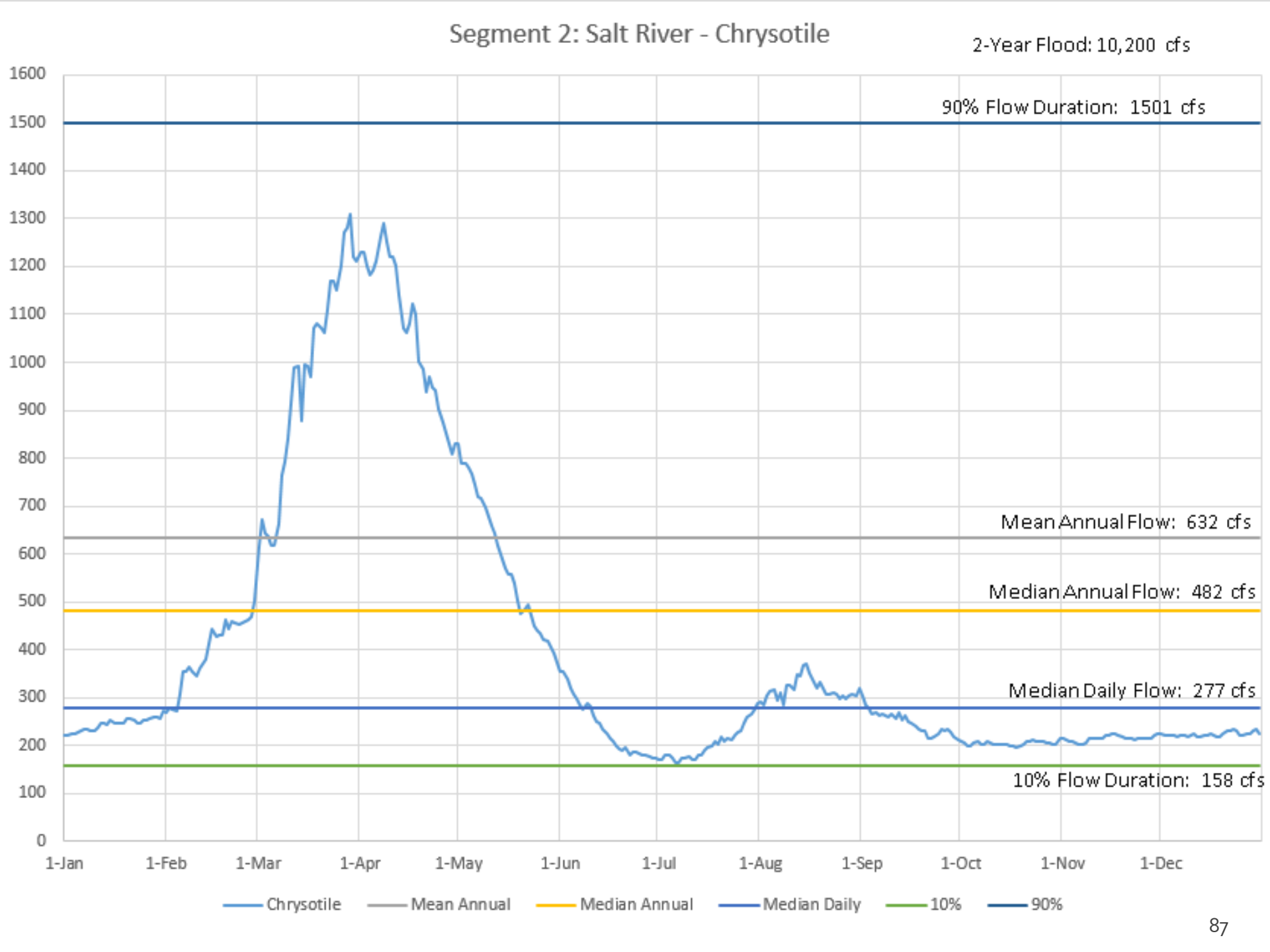
- Segment 6
  - Use USGS Stream Gauge Data – full period of record
    - Add Salt River near Roosevelt, Tonto Ck above Gun Creek, and Verde below Tangle Ck (#9508500; 1946-2015)
    - Flow Duration & Median Daily Estimates
  - Use Burtell's Depletion Estimates for Salt & Verde
    - Segment 6: 251 cfs (Salt-Roosevelt (68 cfs)+ Verde (183 cfs))
  - Use USGS (Thomsen & Porcello) for mean and median annual flow rates
    - No addition for depletion for annual data
  - 2-Year Discharge from ASLD Report

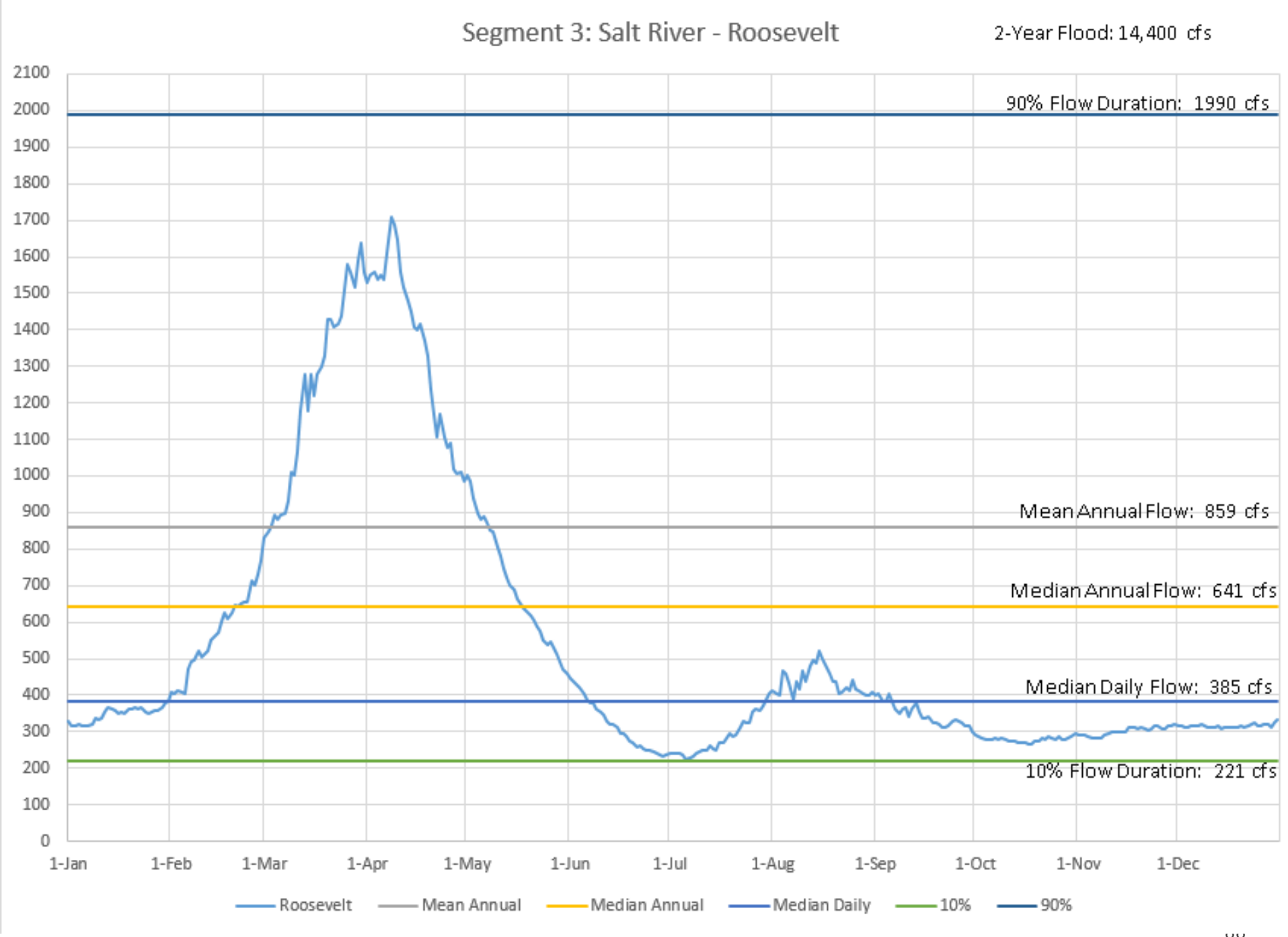
Salt River Recommended Flow Rates

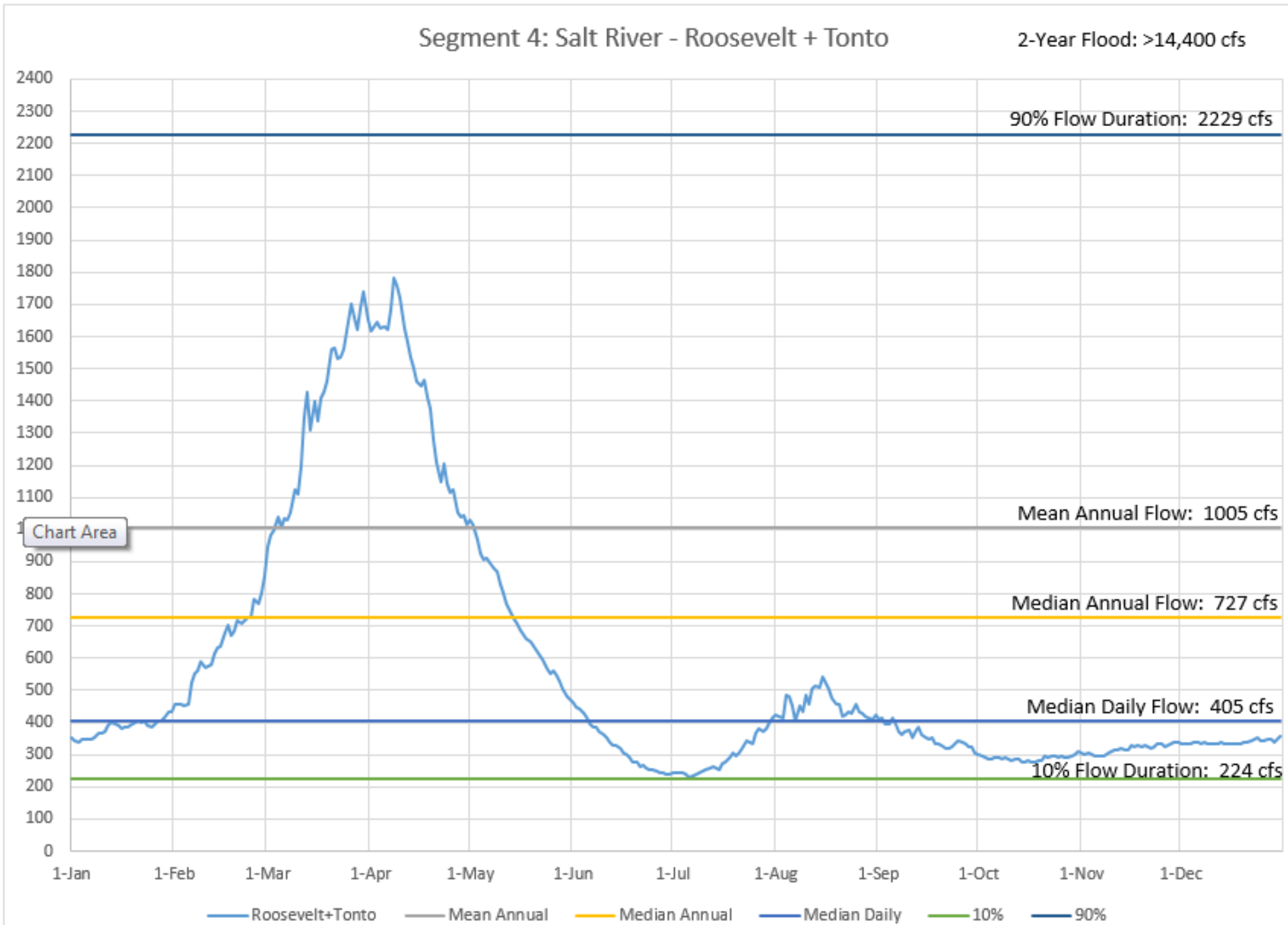
Seg	Flow Descriptor (cfs)						
	Mean Annual	Median Annual	10% Dur'n	Median Daily (50%)	75% Dur'n	90% Dur'n	2-Year Flood
1	556	410	67	167	468	1,492	>7,500
2	632	482	158	277	592	1,501	10,200
3	859	641	221	385	800	1,990	14,400
4	1,005	727	224	405	858	2,229	>14,400
5	1,005	> 727	> 224	> 405	> 858	>2,229	>14,400
6	1,690	1,230	522	819	1,361	3,251	~20,000

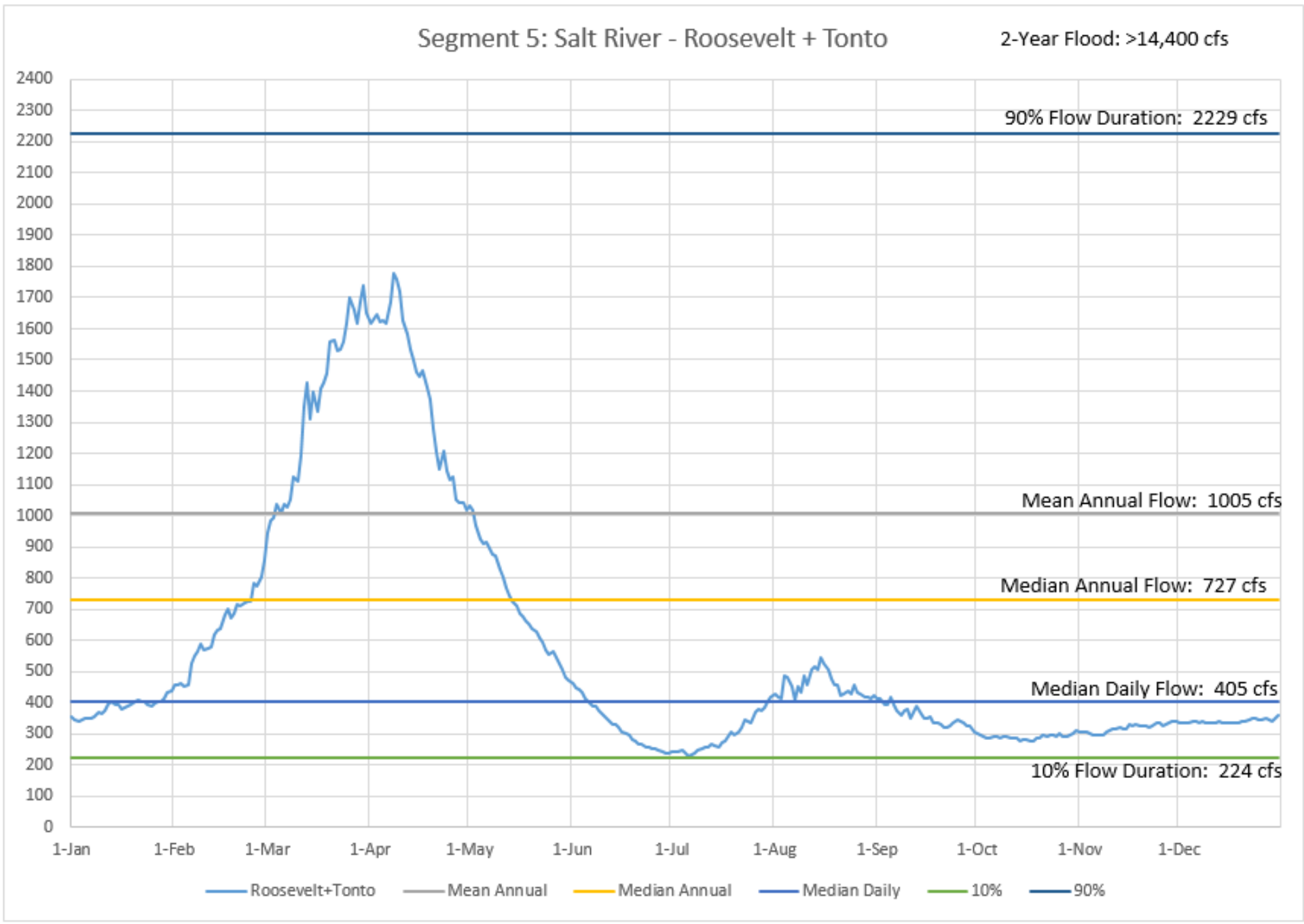
Notes: (1) Flow data obtained from USGS website through 2015
(2) Depletion estimate not added to mean & median annual estimates.
(3) Segment 5 estimates noted by " > " symbol are low due to ungaged drainage areas.
(4) Segment 6 mean & median annual estimates from Thomson & Porcello USGS Report.
(5) 2-year discharge estimates from USGS WRIR 98-4225 (Pope et. al., 1998). Segment 6 value from ASLD Report.

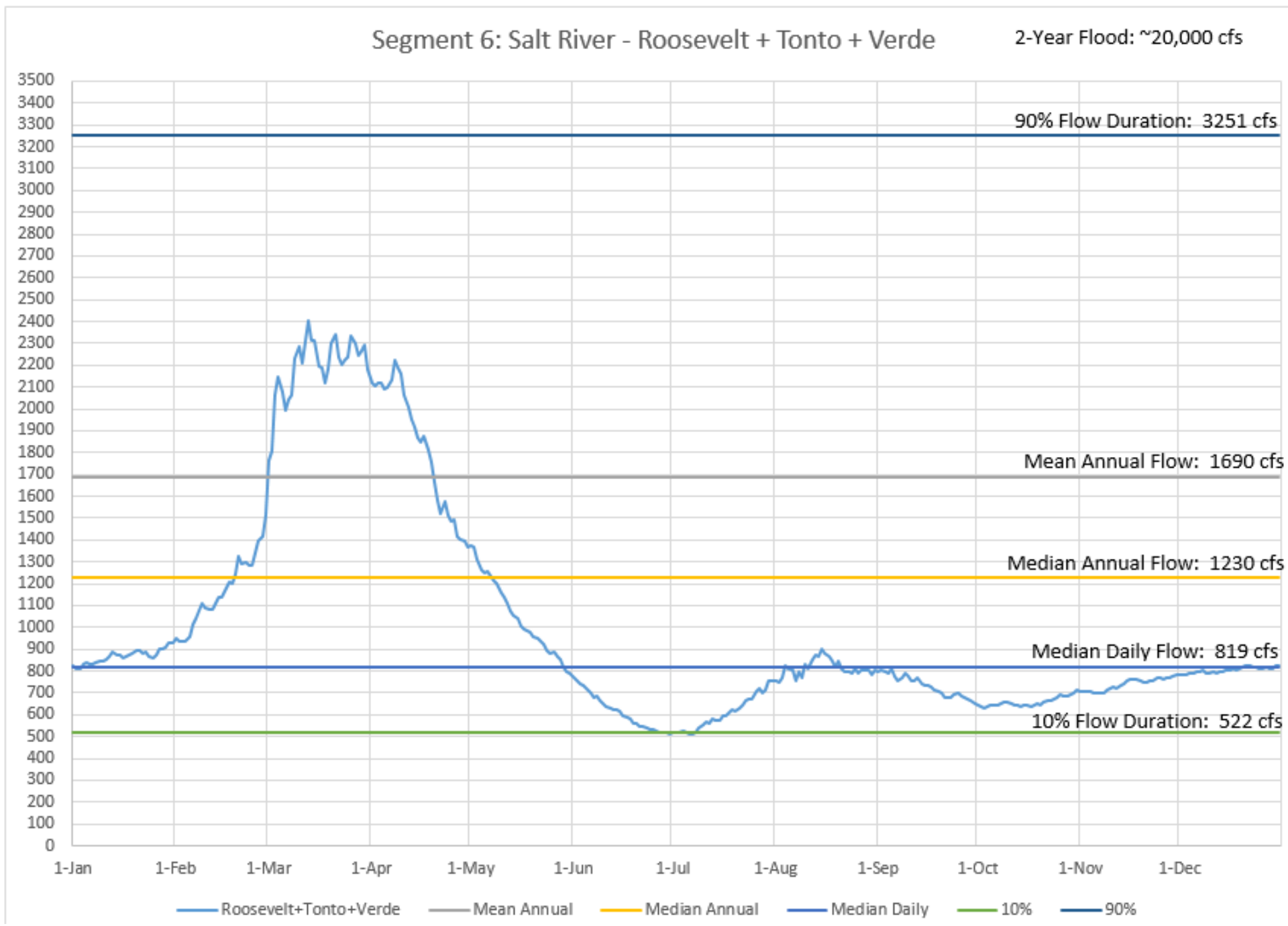

Segment 1 - White River + Black River
2-Year Flood: >7500 cfs
90% Flow Duration: 1452 cfs
Mean Annual Flow: 556 cfs
Median Annual Flow: 410 cfs
Median Daily Flow: 167 cfs
10% Flow Duration: 67 cfs
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
White+Black
Mean Annual
Median Annual
Median Daily
10%
90%


Segment 2: Salt River - Chrysotile
2-Year Flood: 10,200 cfs
90% Flow Duration: 1501 cfs
Mean Annual Flow: 632 cfs
Median Annual Flow: 482 cfs
Median Daily Flow: 277 cfs
10% Flow Duration: 158 cfs
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Chrysotile
Mean Annual
Median Annual
Median Daily
10%
90%


Segment 3: Salt River - Roosevelt
2-Year Flood: 14,400 cfs
90% Flow Duration: 1990 cfs
Mean Annual Flow: 859 cfs
Median Annual Flow: 641 cfs
Median Daily Flow: 385 cfs
10% Flow Duration: 221 cfs
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Roosevelt
Mean Annual
Median Annual
Median Daily
10%
90%


Segment 4: Salt River - Roosevelt + Tonto
2-Year Flood: >14,400 cfs
90% Flow Duration: 2229 cfs
Mean Annual Flow: 1005 cfs
Median Annual Flow: 727 cfs
Median Daily Flow: 405 cfs
10% Flow Duration: 224 cfs
Chart Area
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Roosevelt+Tonto
Mean Annual
Median Annual
Median Daily
10%
90%

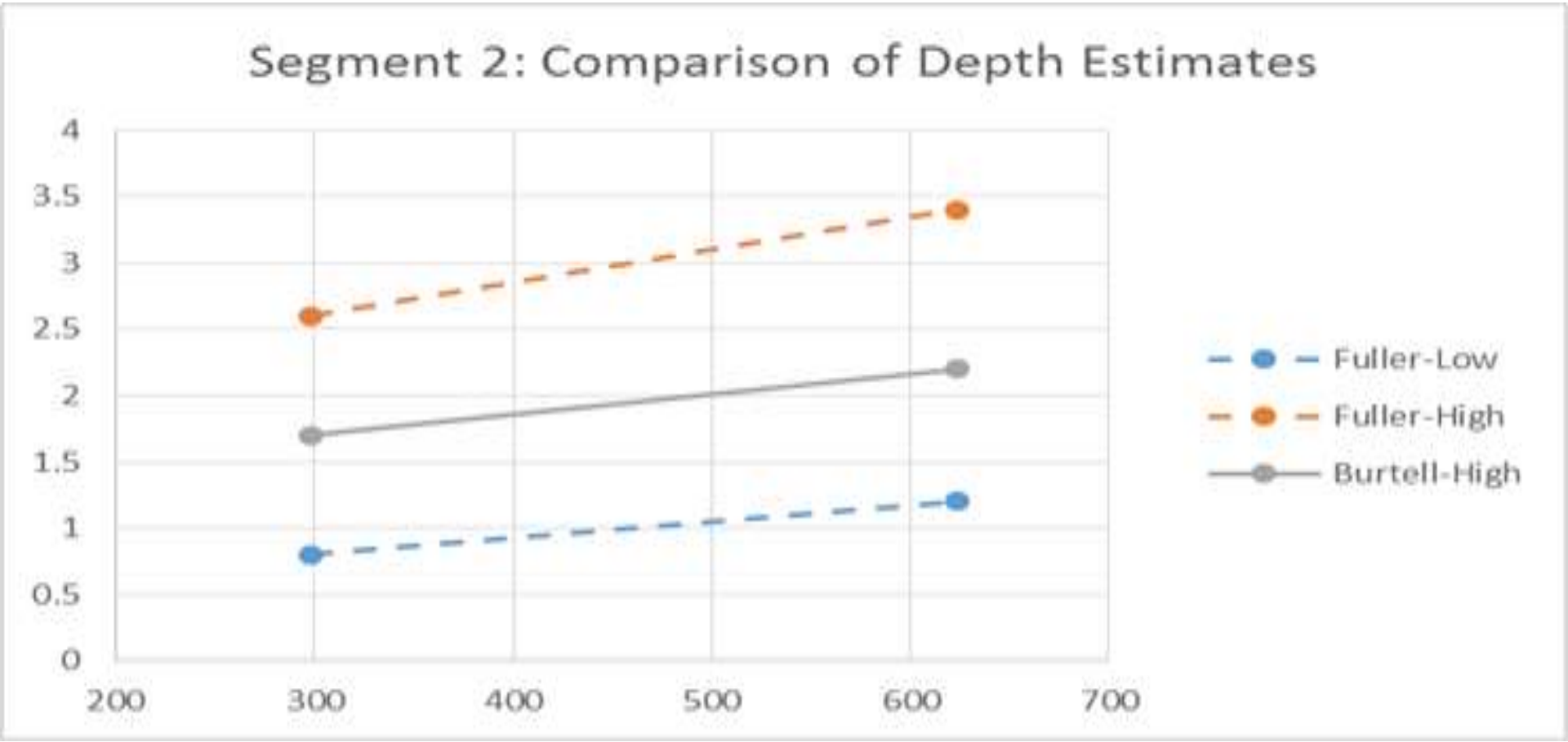

Segment 5: Salt River - Roosevelt + Tonto
2-Year Flood: >14,400 cfs
90% Flow Duration: 2229 cfs
Mean Annual Flow: 1005 cfs
Median Annual Flow: 727 cfs
Median Daily Flow: 405 cfs
10% Flow Duration: 224 cfs
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Roosevelt+Tonto
Mean Annual
Median Annual
Median Daily
10%
90%


Segment 6: Salt River - Roosevelt + Tonto + Verde
2-Year Flood: ~20,000 cfs
90% Flow Duration: 3251 cfs
Mean Annual Flow: 1690 cfs
Median Annual Flow: 1230 cfs
Median Daily Flow: 819 cfs
10% Flow Duration: 522 cfs
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Roosevelt+Tonto+Verde
Mean Annual
Median Annual
Median Daily
10%
90%

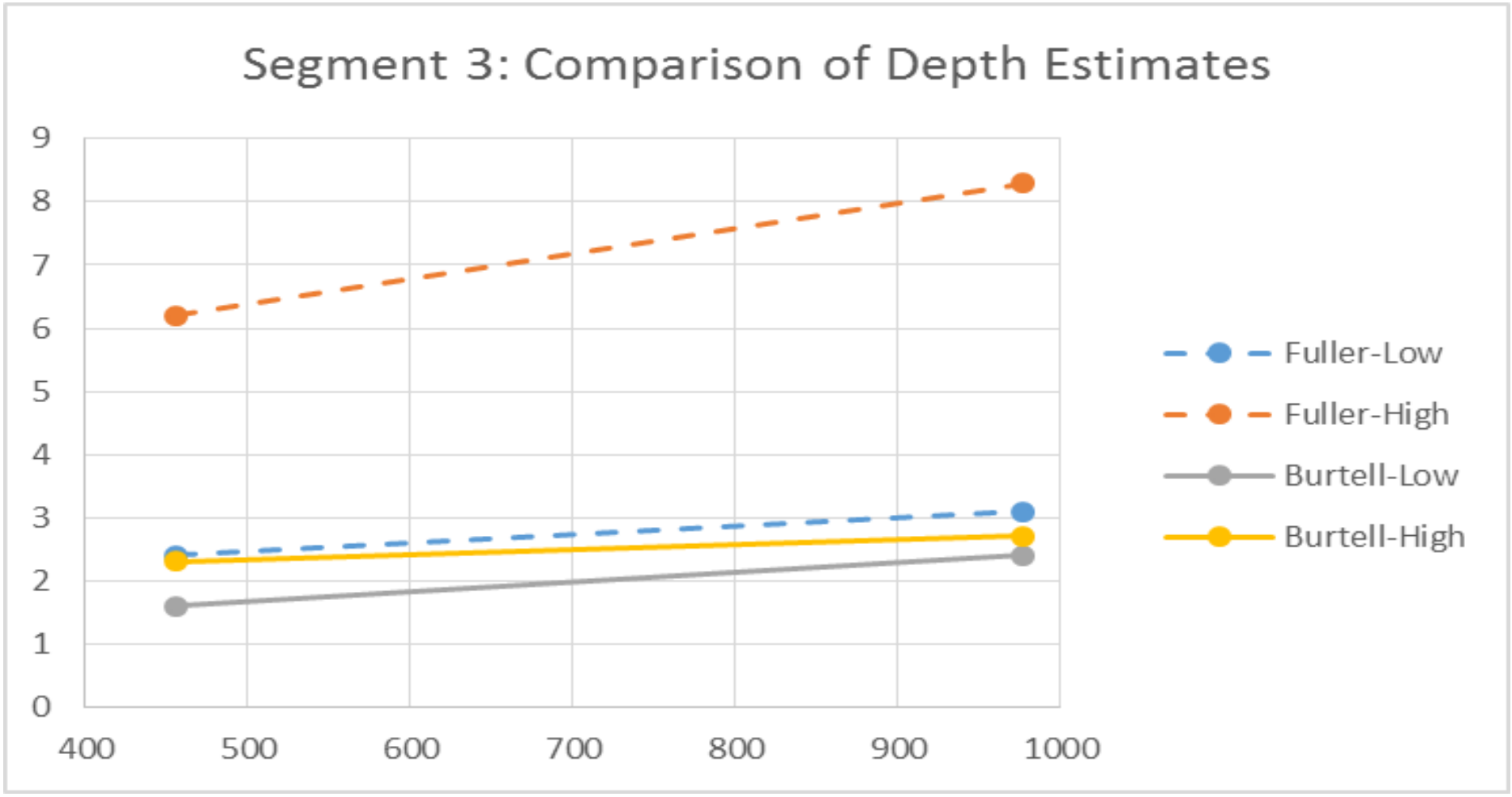
Salt River Rating Curves

- Perspectives on Rating Curves & Navigability
  - ASLD Rating Curves
    - Error Checking
  - How Different is Different?
  - How Important are the Rating Curves?
  - Impact of Flow Rate Differences?
  - What Flow Rates Should be Used?

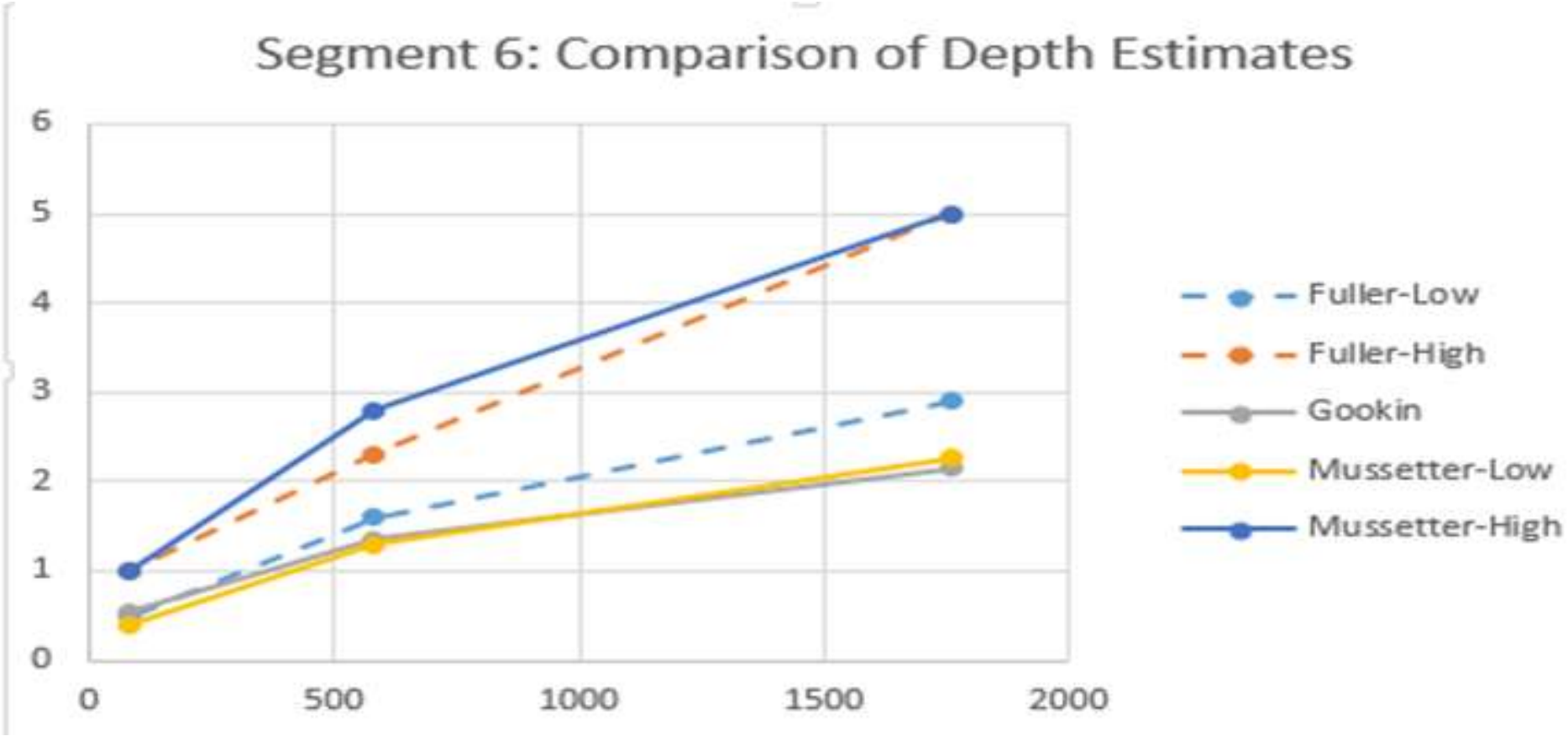
Rating Curves: Differences



Rating Curves: Differences



Rating Curves: Differences



Salt River Rating Curves

- Perspectives of Rating Curves
  - What Does River Depth Mean?
    - *"I mean, putting a depth on any river is sort of an amorphous sort of definition. I mean, rivers are defined by obstacles, rocks, and deep channels, shallow channels, deep channels. You know, they're dynamic animals. So to put a depth on a river, it's just really not a logical way to look at it." (376:3-8, Salt River Testimony)*
      Tyler Williams, Boating Expert, Professional Boater & Author
  - Areas of Agreement:
    - Segment 1, 4, 5
    - Velocity & Width
    - Depths vs. Basic Boat Types
  - Rating Curves & Beyond…

Beyond Rating Curves

- The Biggest Difference Between Experts
  - On-the-River Experience
  - Ranges of Disciplines Considered
  - Reliance on Computer Models
- Significance of Differing Flow Depth Estimates on:
  - Boat Type
  - Seasonality

Beyond Rating Curves: Verification & Integration

- Historical Descriptions
- Ferry Boats
- Field Work & Observations
- Boat Trips
- USGS Rating Curves
- Historical Photographs
- Historical Maps
- Historical Boating Accounts
- Beaver & Fish
- Hohokam & Early Anglo Irrigation

Beyond Rating Curves

January 15, 1901 – ASU Special Collections; Littlefield: Fig 59

USGS Gage Data:

- Salt McDowell: 254 cfs
- Verde McDowell: 250 cfs
- Maximum @ Tempe: 504 cfs

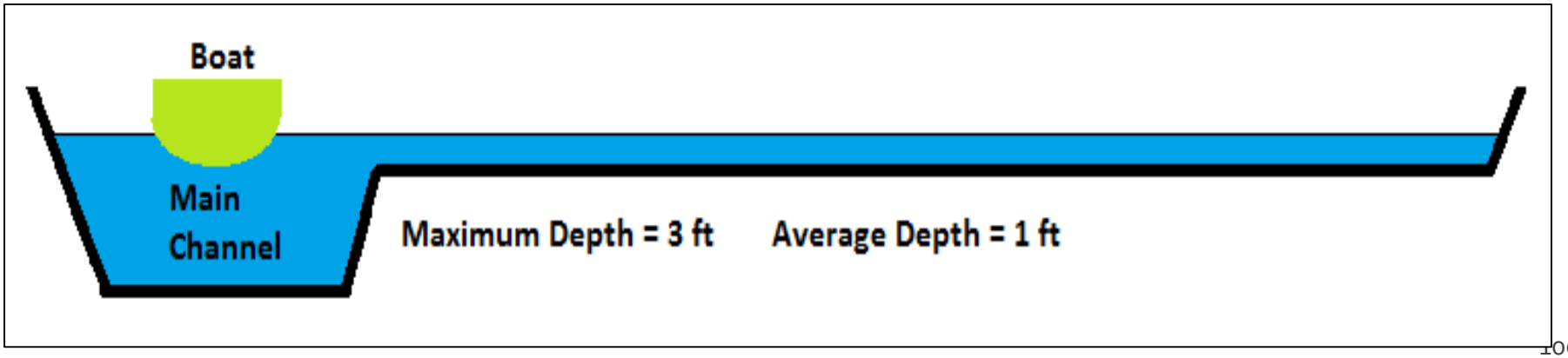
Deep enough to float (and need) the ferry.

Gookin:* 1.2 ft
Mussetter: 1.2-2.6 ft
Fuller: 1.4-2.1 ft

All are low

Specific Rebuttal Issues

- ASLD's N Values
- Average Depth vs. Maximum Depth
- Topographic Map Accuracy
- Rating Curve Cross Section Location Selection
- How Accurate Can a Rating Curve Be?
- ASLD Source Data



Recommended Rating Curves

- Use the Recommended Discharges
  - 10% to 2-Year Peak
- Maximum, not Average Depth
- Segment 6: Use Mussetter's 10 Sections
- Segment 5: Use Segment 6, Section #6
- Segment 4: Use Burtell's (High) Curve @ Roosevelt
- Segment 3: Use Burtell's (High) Curve @ Roosevelt
- Segment 2: Use Burtell's Mean Depth Curve nr Chrysotile, Adjust for Maximum Depth

Beyond Rating Curves

Seg	Flow Rate Type Representative of Riffle Sections along the Main Channel Thalweg (not Pools)					
	Mean Annual	Median Annual	10% (Entire Year)	Median Daily (Entire Year)	90% (Entire Year)	High-Flow Boating Season (Feb-May)
2	2.2 ft	2.0 ft	1.2 ft	1.6 ft	3.0 ft	1.8-2.4 ft
3	2.7 ft	2.5 ft	2.0 ft	2.2 ft	3.2 ft	2.5-3.2 ft
4	2.8 ft	2.7 ft	2.0 ft	2.3 ft	3.3 ft	2.6-3.2 ft
5	2.6 ft	2.2 ft	1.1 ft	1.6 ft	3.8 ft	2.0-3.5 ft
6	2.2-4.9 ft	1.9-4.2 ft	1.2-2.5 ft	1.6-3.4 ft	3.0-5.8 ft	2.5-5.5 ft

See notes in written summary

Susceptibility to Navigation

- Flow Depth
  - Rating Curves & Beyond
- Flow Duration
  - Percent of Time Boatable Conditions Exist
- Flow Seasonality
  - Regular Season of High Flow
- Boat Types
  - Low Draft Boats, Wood & Canvas
- Obstacles to Navigation

Susceptibility By Rating Curve

- Year-Round
  - Canoes (Seg 2-6)
  - Low-Draft, Maneuverable Flat Boats (Seg 2-6)
- Seasonal High Flow
  - Canoes & Maneuverable Flat Boats (Seg 2-6)
  - Loaded Small Boats, Low Draft (Seg 2-6)
  - Loaded Flat Boats, Mod Draft (Seg 6)

Expert Opinions on Susceptibility

- Boated the Salt River
- Field Trips to the River
- Flew Over the River
- Expertise in Modern Boating
- Expertise in Historical Boats

- Use this experience to interpret river conditions with respect to rating curve depths and boat types

None of These Prevent Navigation on the Salt River:

- Rapids & Riffles
- Beaver Dams
- Braiding
- Marshes
- Flash Floods
- Erratic Flow

- According to:
  - The Qualified Experts Who Testified on the Salt
  - The Historical Accounts of Boating

Rapids & Riffles

- Many Navigability Decisions on Rivers with Rapids
- Rapids Not an Issue for Segment 6 and 5
- Downstream vs. Upstream Travel
- Meaning of Rapids Ratings I-V: Boatable
  - Difference is Difficulty
  - Class VI is Unboatable
  - Many Boating Guides Available for Salt
- Rapids & Riffles Impact Boat Type
  - Small, low draft boats designed for rapids
  - Heavily loaded, deep draft boats not used in rapids

Rapids & Riffles

- What Did the Qualified Boating Experts Say About Rapids on the Salt River?
  - Not an issue in Segments 3-6
  - Easily portaged or lined if needed in Segment 2
  - Boatable at a wide range of ordinary discharges (below 10% rate to above 90% rate)

Braiding

- Salt River Boating Channel is Not Braided
- No Expert Who Has Boated the Salt Reported Any Problems Relating to Braiding
  - Every "braid" identified by Mr. Burtell & Dr. Mussetter has been boated. Routinely. Without difficulty.
- No Historical Account Mentions Any Problem Due to Braiding
- Split Channels Are Not Necessarily Shallower

Marshes

- There is no map or photograph in evidence that shows a marsh located on ANY segment of the Salt River over the area of the low flow or boating channel.

- No modern boating expert or historical account of the Salt River reports ANY problem with boating because of marshy conditions.

Flash Floods & Erratic Flow

- Segments 1-5
  - Portions of Segment 1-4 may be at risk of flash floods.
  - Such events are extremely rare, i.e., NOT ordinary
  - Even more rare are flash floods that are so flashy that boaters would be unable to avoid the hazard.
- Segment 6 was NOT subject to flash floods

- Salt River Flow Was Not Erratic From the Perspective of Boating
  - Range of Ordinary Flow Conditions Are Boatable

Beaver Dams on the Salt River

- Expert Opinion
- Boater's Opinion
- Historical Accounts
- Physically Possible?
- Enough Trees?
- What About Floods?
- Did Beavers Need Dams?

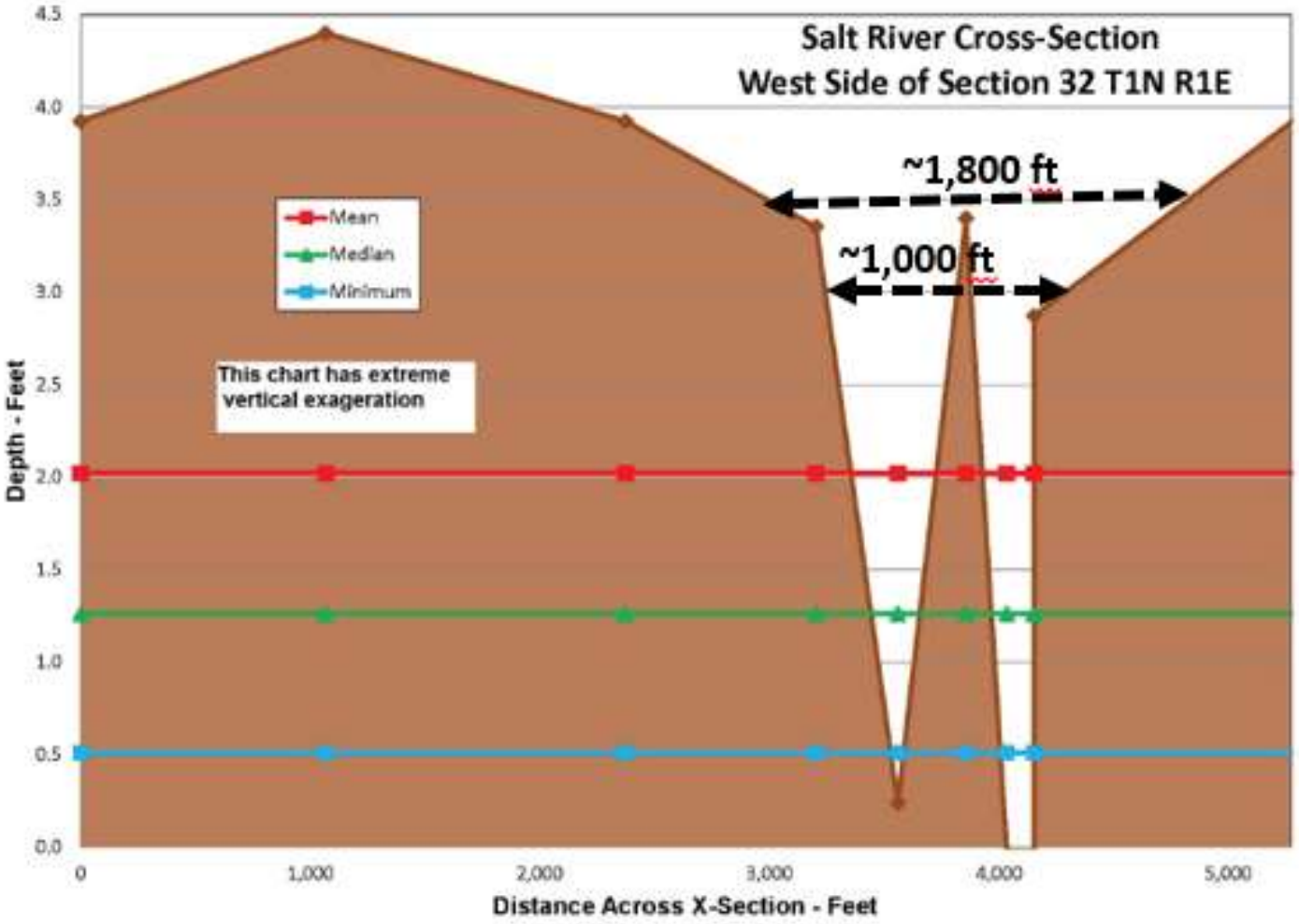
Beaver Dams on the Salt River

- Expert Opinions:
  - Beaver Were Found on Salt River Prior to Statehood
  - Beavers Do Live in Segments 1-3, 5-6 Today
    - Beaver Sign Seen, No Dams Seen in Segments 1-3, 5
  - Beaver Dams Not Found on Segments 1-3 Today
  - Beavers Do Not Require Dams to Live
    - Not on Pool & Riffle Streams With Adequate Pool Depths
    - May Not Build Dams on Rivers with Large Floods & Channels
  - Beaver Dams are Not an Obstruction for Small, Low Draft Boats
- No Historical Account Mentions Problems With (or Existence of) Beaver Dams on Salt River Channel
  - Several accounts of beaver trapping in Segment 6

Beaver Dams on the Salt River

- Mr. Gookin Says:
  - Numerous Beaver Dams Existed on Segment 6
    - One every few hundred yards
    - 100's of beaver dams on Segment 6
  - Beaver Dams Are Similar to Diversion Dams
  - Beavers Dams Created the Marshes Along the Salt
  - Beaver Dams Still Exist on the Salt River
  - Beaver Dams Needed to Create 3 ft. Depth

Beaver Dams on Segment 6?



- 1800 ft long dams?

~170 trees needed per dam

~41,000 trees needed for 1 dam every 300 yds

~ Would deforest the entire river bank in less than 1 year

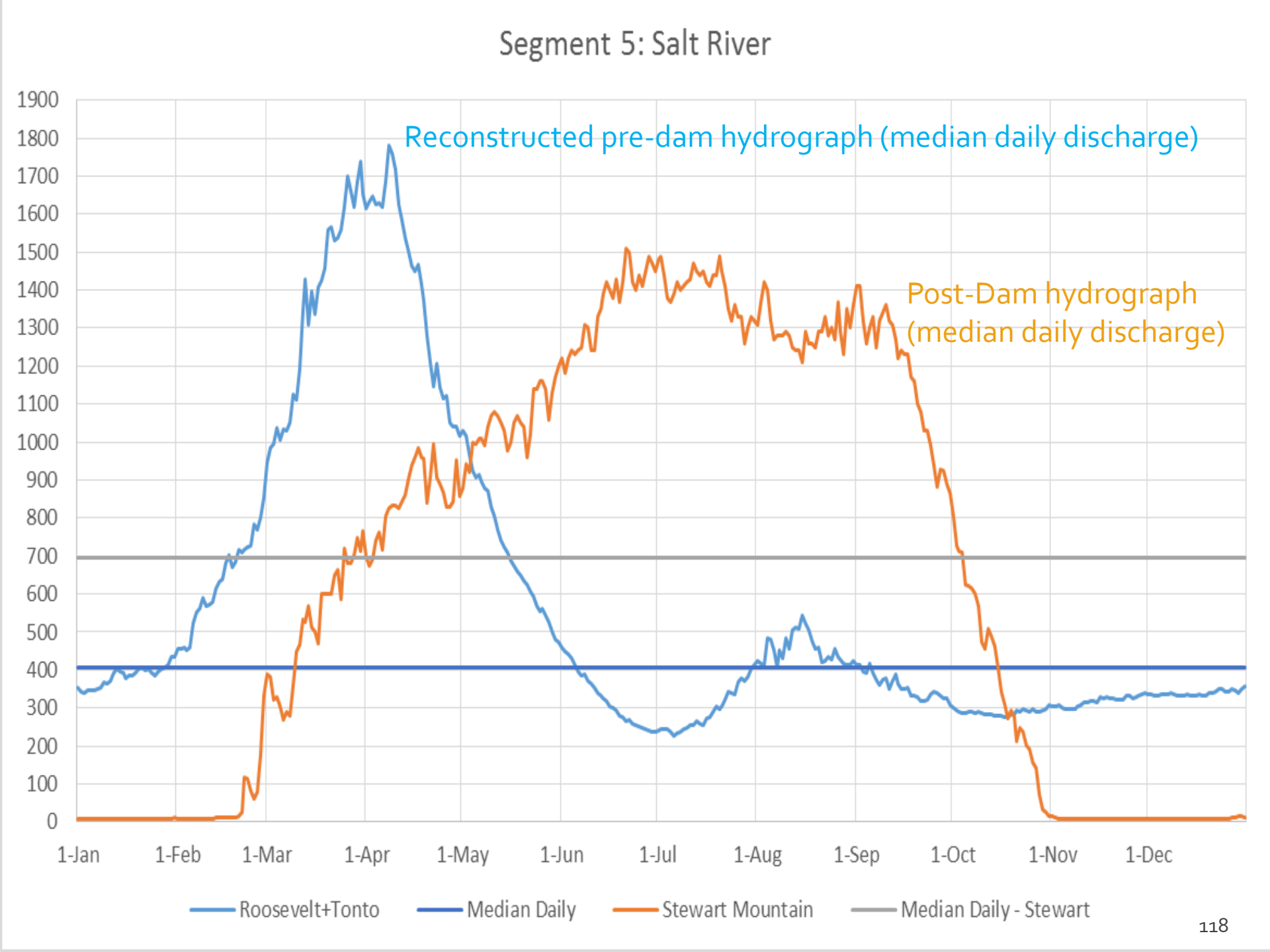
Conclusion: Impossible

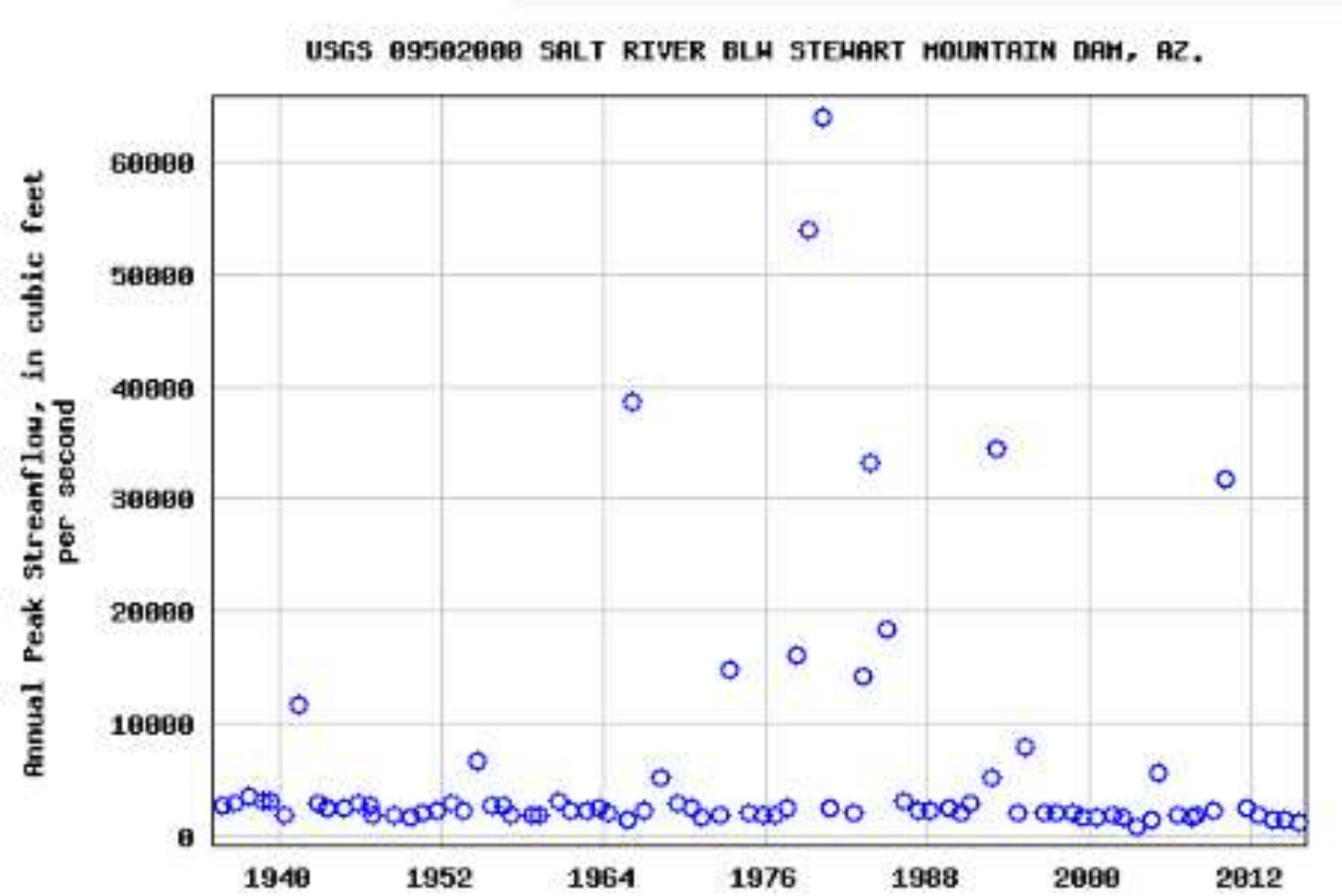
Is Segment 5 in its Ordinary & Natural Condition Today?

Summary of Non-Navigability Expert Opinions on Segment 5		
Claim	**By**	**Evaluation**
Channel bed was sandier in past	Mus	Possible Near Dam, No Evidence
Channel was less stable in the past	Mus	Possible, Irrelevant to Navigability
Channel has degraded (scour)	Mus, Gkn	Possible Near Dam, No Evidence
Channel is deeper & narrower	Mus, Gkn	No Evidence, Field Evidence Contradicts
Channel is more single thread now	Mus, Gkn	Minor, Irrelevant Change
Channel has moved	Gkn	Minor, Irrelevant to Navigability
Channel slope has changed	Gkn	No Evidence
Bank vegetation is denser	Gkn	No Evidence
Hydrology has changed	Mus, Gkn	True

Is Segment 5 in its Ordinary & Natural Condition Today?

- Hydrology: Flow Regulation
  - Change in Seasonality of Runoff
    - High flow season shifts from winter to summer
      - Median daily rates are similar
      - Annual daily median rate increases
      - High flow season duration is longer
    - Low flow season goes to near-zero (~10 cfs)
      - SRP shuts off river for several months per years.
  - Impact on Floods
    - Flood peak & volume generally reduced
    - Floods not eliminated


Segment 5: Salt River
Reconstructed pre-dam hydrograph (median daily discharge)
Post-Dam hydrograph (median daily discharge)
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Roosevelt+Tonto
Median Daily
Stewart Mountain
Median Daily - Stewart


USGS 09502000 SALT RIVER BLW STEWART MOUNTAIN DAM, AZ.
Annual Peak Streamflow, in cubic feet per second
60000
50000
40000
30000
20000
10000
0
1940
1952
1964
1976
1988
2000
2012

Is Segment 5 in its Ordinary & Natural Condition Today: Channel Pattern

- Channel Pattern
  - Nearly Identical 1903-2015
  - 1903: 17% split channel
  - 2015: 12% split channel
- Channel Position Nearly Identical
  - A few local changes
- Channel Width (1904-2007)
  - USGS Quad Maps & USRS Maps
  - Channel symbology did not change: blue corridor of variable width (~150-300 ft). Conclusion: no significant change in width.

Slide 95, 96: Fuller PowerPoint

Is Segment 5 in its Ordinary & Natural Condition Today: Bank Vegetation

Upstream from Verde River (1934)

99

Upstream from Verde River (2010)

98

From Mussetter, Slides 98-99

- Floodplain & Upland Vegetative Cover Increases (Grazing Affect)
- Channel Bank Vegetation About the Same

Is Segment 5 in its Ordinary & Natural Condition Today: Bank Vegetation

Sept.9,1938
2390 cfs

March 7, 1979
13 cfs
Taken after
1978 & 79
Floods

215 Source: Webb pg. 324

Gookin Slide 215

More bank veg'n in 1938 than in 1979.

Is Segment 5 in its Ordinary & Natural Condition Today: Bank Vegetation

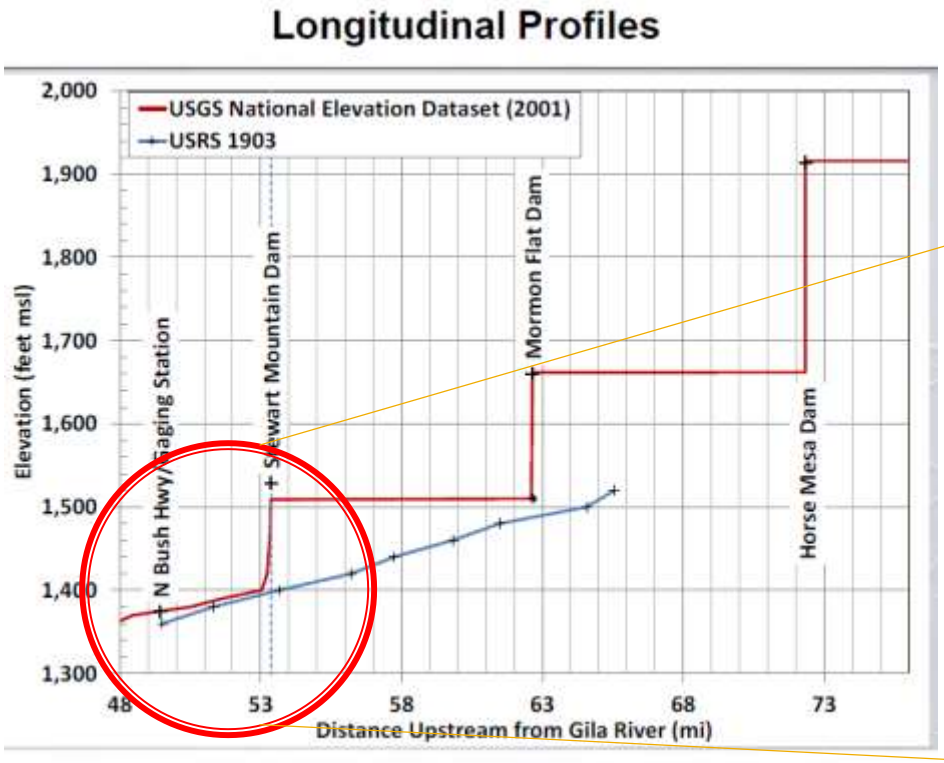
Historical Photographs

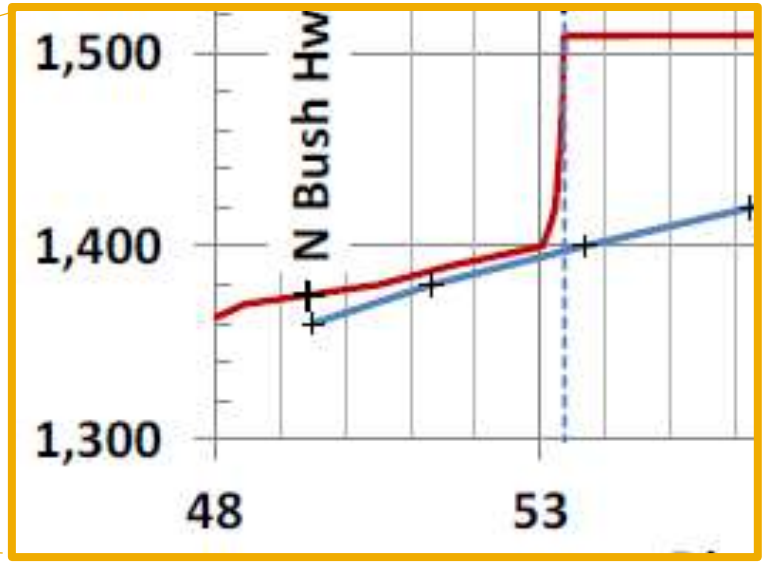
Date: pre-1908
Location: Salt/Verde Confluence
Source: Beasley, 1908

Is Segment 5 in its Ordinary & Natural Condition Today: Channel Depth

- Classic Indicators of Post-Dam Degradation (deepening) Not Found in Segment:
  - Perched channels
  - Hanging tributaries
  - Extensive cut banks
  - Hanging, exposed roots
  - Headcuts – main stem Salt or tributaries

Is Segment 5 in its Ordinary & Natural Condition Today? Channel Depth





66

Mussetter Slide 66: Shows INCREASE in bed elevation 1903-2001

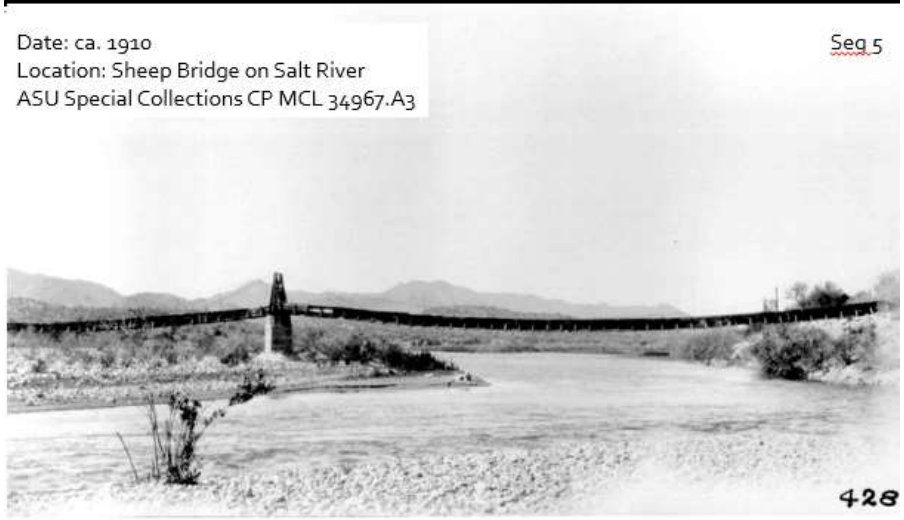
Is Segment 5 in its Ordinary & Natural Condition Today? Channel Depth

- Sheep Bridge – piers still in place

Historical Photographs

Date: ca. 1910
Location: Sheep Bridge on Salt River
ASU Special Collections CP MCL 34967.A3

Seg 5



151

Is Segment 5 in its Ordinary & Natural Condition Today: Channel Depth

- Flow Depths: Is the Channel Deeper Today?
  - Ground Truthing Estimates:
    - Historical Boating Accounts - No Problems in Segment 5
    - Historical Descriptions – Chest deep in winter at fords
    - Sheep Bridge Crossing
    - Boating @ 8 cfs
    - Field Observations of River Morphology

Is Segment 5 in its Ordinary & Natural Condition Today? Channel Depth

- How did Verde Respond to Dams?
  - Channel is more "braided"
  - No obvious degradation
  - "Few reservoir related morphological changes to the river below the dam" Mussetter, 2004, p. 6.2, 6.3
- How did Gila respond?
  - No obvious signs of degradation

Is Segment 5 in its Ordinary & Natural Condition Today: Channel Depth

- Why Would Segment 5 Not Have the Classic Post-Dam Response?
  - Coarse bed material
  - Pool & riffle channel pattern
  - Bedrock – shallow, and locally in banks
  - Caliche & clay banks
  - Well-vegetated banks
  - Sediment from tributaries
  - Infrequency of bankfull discharges

Is Segment 5 in its Ordinary & Natural Condition Today: Conclusion

- The Salt River in Segment 5 is substantively in same condition today as in its ordinary & natural condition.
- Boat trips on the river today are in meaningfully similar conditions to the pre-development, ordinary and natural conditions of the Salt River

Segments 1-4 vs. Segments 5-6

Characteristic	Segments 1-4	Segment 5	Segment 6
Rapids (Class II-VI)	II-IV	No	No
Riffles (Class I)	Yes	Yes	Possible
Narrow Canyons	Yes	No	No
Slope	Steeper	Flatter	Flattest
Channel Bed Materials	Cobbles, Gravel Bedrock	Cobbles, Gravel Minor Bedrock	Sand & Gravel
Flow Rates	Lowest		Highest
Human Impacts	Lowest		Highest

Surveyors Meanders & Patents

- GLO Survey Designations Not Definitive for Navigability Decisions.
  - Basis of GLO Surveyor Designation is Unknown.
  - Past Court Decisions
- US Patent Offices Did Not Make New Particularized Assessments of Navigability

History Rebuttal Points

- Salt River Corridor was NOT densely populated in 1868.
- Dams began to block the Salt River immediately after the first settlers arrived in 1868.
- Diversion dams were an obstacle to some types of commercial boating.
- The railroad arrived early (1879 @ Maricopa) relative to population growth. Alternative transportation methods available.
- No alternative water supply for irrigation.

History Rebuttal Points

- Apache threat existed along Salt River until 1880's
- The Globe mining district was NOT located on the Salt River. Ore was sent east for processing, not in direction of Salt River.
- Hohokam civilization had the largest irrigation system in the Americas, which required reliable, significant flow in the Salt River. Diversions required flows depths and channel stability.

History: Key Findings

Canals

▪ Swilling's (Salt R Canal)	1867	Jointhead Dam
▪ Maricopa Canal	~1870	Jointhead Dam
▪ Tempe Canal	1870	9 mi. upstream JD
▪ Broadway Canal	1870	4 mi. upstream JD
▪ Utah Canal	1877	14 mi. upstream JD
▪ Mesa Canal	1878	16 mi. upstream JD
▪ Grand Canal	1878*	3 mi. upstream JD
▪ San Francisco Canal	1880	Tempe Canal
▪ Arizona Canal	1883	Arizona Dam
▪ Highland Canal	1888	8 mi. upstream JD
▪ Consolidated Canal	1891	Arizona Dam

ASLD, Table 7-8 (Lower Salt)

Conclusions

- Salt River* is a Navigable Watercourse

  * Segment 2-6

  - Existed in February 1912
  - Was used as highway of commerce
  - Was susceptible to use as highway of commerce
    - For trade and travel on water
    - By customary modes of travel on water

"Navigable" or "navigable watercourse" means a watercourse that was ***in existence*** on February 14, 1912, and at that time ***was used or was susceptible*** to being used, in its ***ordinary and natural condition***, as a highway for commerce, over which trade and travel were or could have been conducted in the ***customary modes*** of trade and ***travel on water***. **A.R.S. § 37-1101(5)**