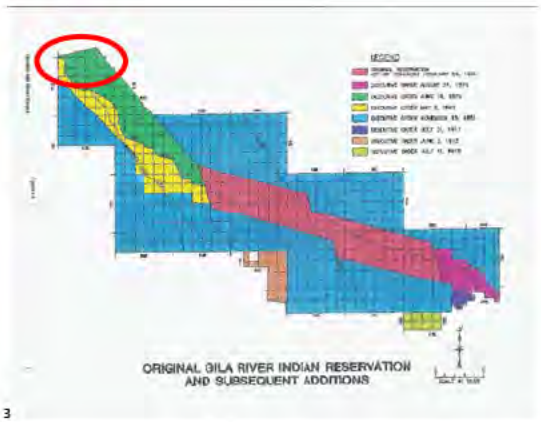
Salt River Navigability
by
T. Allen. J. Gookin P.E., R.L.S., P.H.
November 2015

1

Sources

- Gookin pg. # in lower left corner Refers to Exhibit C022.
- Fuller Slide # Refers to Exhibit ASLD # 364.

2



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Terminology

Fuller Slide Modified

- Fords:
  - Definition: A **ford** is a shallow place with good footing where a river or stream may be crossed by wading or inside a vehicle.
  - May occur naturally
  - Implies most reaches not ford-able at Flood Flows

4

History: Key Findings

Fuller Slide Modified

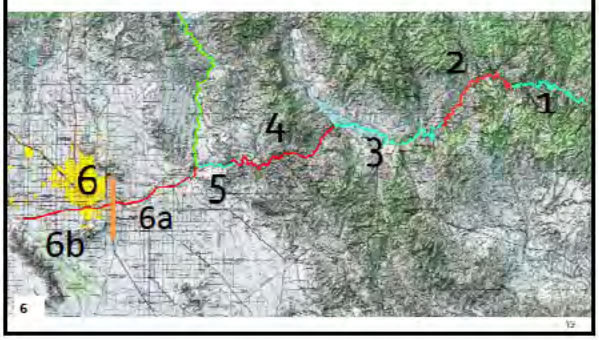
- Native American
  - Salt River Segments 1-4
    - Apache/Yavapai Tribes
    - Seasonal Occupation of River Valleys & Canyons
    - Flood Irrigation, Small Scale
    - Some Irrigation Canals in Tonto Basin
  - Salt River Segments 5-6
    - Pima @ Salt/Gila Confluence
    - Maricopa - mostly on Gila River
    - Mostly unoccupied in 18th century – buffer zone
    - Irrigated agriculture
  - No Records of Native American Boat Use on Salt

Backwards

5

Segmentation

Fuller Slide Modified



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Flow

7

Salt River Hydrology

Fuller Slide

Flow Estimates (JE Fuller, 2003; Pope et. al., 1998; Thomsen & Porcello, 1991)

Gage Station	Segment	Flow Rate (cfs) 90%	Flow Rate (cfs) Median (50%)	Flow Rate (cfs) 10%	Gage Period
White River Black River	- -	(35) (39)	(90) (109)	(587) (1730)	1958-1996 1958-1996
White + Black	1	74	194	1,747	
Chrysotile	2	130	266	1,620	1925-1969
Roosevelt	3 4	159	341	2,120	1914-1996
Roosevelt, USGS	5	>159	992 (USGS –VR,Tangle)	>2,120	
USGS	6	277 (Salt + Verde)	1230* (USGS, 1991)	3,062 (Salt + Verde)	-

NOTES:
- Includes post development (non natural condition) flow data. Underestimates natural flow rates.
- All flow rates shown are from long-term, modern period gage records.
- Use of Roosevelt gage data for Segments 4 does not include tributaries inflows from Tonto Creek and other downstream perennial tributaries, and therefore underestimates actual historical flow rates.
- Diversions above Roosevelt total 8,460 ac. ft. (Table 12, ASLD Report)
- * Pre-development flow estimate by USGS (Thomsen & Porcello, 1991)

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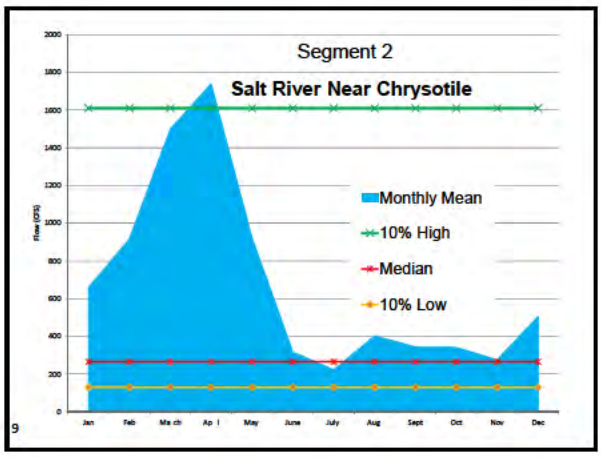

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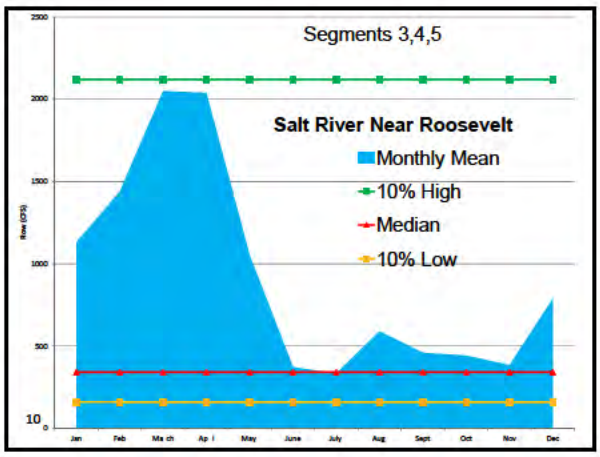

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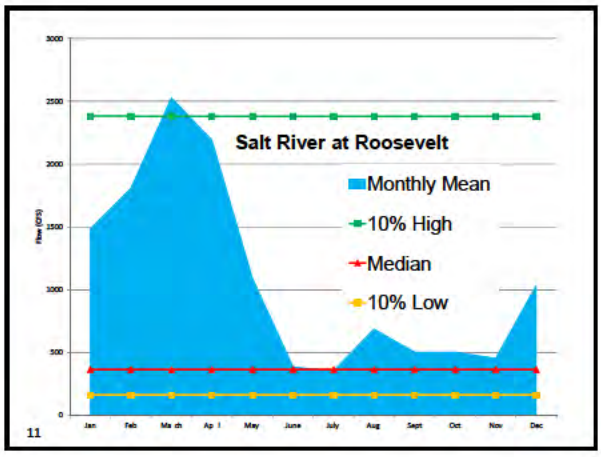

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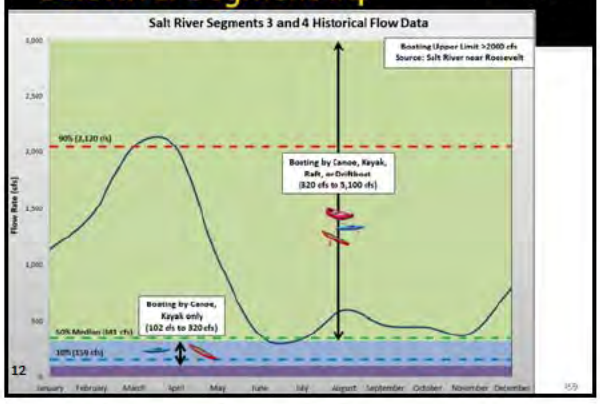
Salt River Segment #4

Fuller Slide



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Salt River Segment #5

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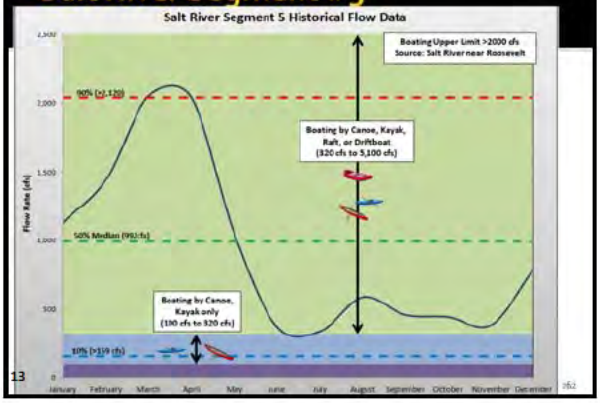

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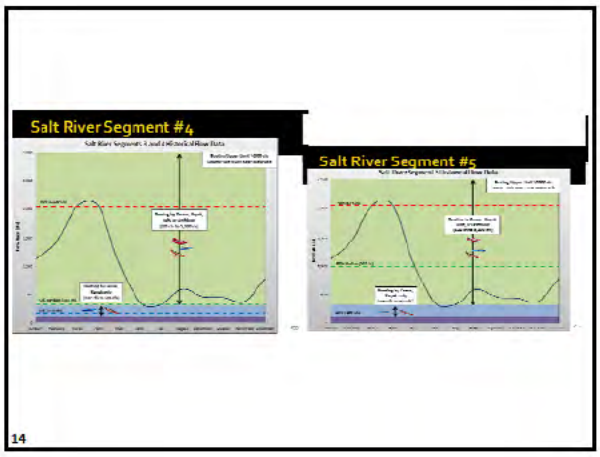

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Fuller Slide Modified

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Gage Station	Segment	Flow Rate (cfs) 90%	Flow Rate (cfs) Median (50%)	Flow Rate (cfs) 10%	Gage Period
White River Black River		(35) (39)	(99) (109)	(567) (1,130)	1958 1996 1958 1996
White + Black	1	74	199	1,797	
Chrysotile	2	130	266	1,610	1925 1996
Roosevelt	3, 4	159	341	2,120	1914-1996
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USGS	6	277 (Salt + Verde)	1230* (USGS, 1932)	3,062 (Salt + Verde)	-

NOTES:
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- Use of Roosevelt gage data for Segments 4 does not include tributaries inflows from Tonto Creek and other downstream perennial tributaries, and therefore underestimates actual historical flow rates.
- Diversions above Roosevelt total 8,560 acres (Table 11, ASLD Report)
* Pre-development flow estimate by USGS (Thomsen & Porcello, 1992)

15

Thomsen and Porcello Provided Median Annual Flow

Fuller Assumed That Median Annual Flow/365 = Median Daily flow
Major Mistake
Also Fuller Mixed Techniques

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Mathematical Calculation

- Thompsen and Porcello pg. 10, 11
  - Median Annual Flow 889,000 Acre Feet /Year
  - Divide by 365.25 days/year
  - Equals 2,434 AF/Day
  - Divide by 1.983471 CFS per AF per Day
  - Equals 1227 CFS
  - Rounds to <u>1230 CFS</u>

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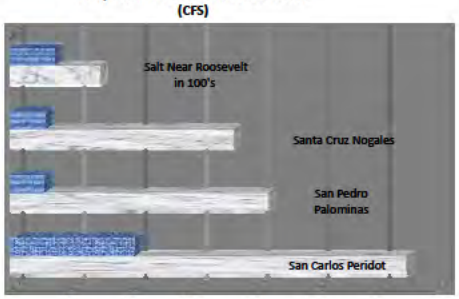
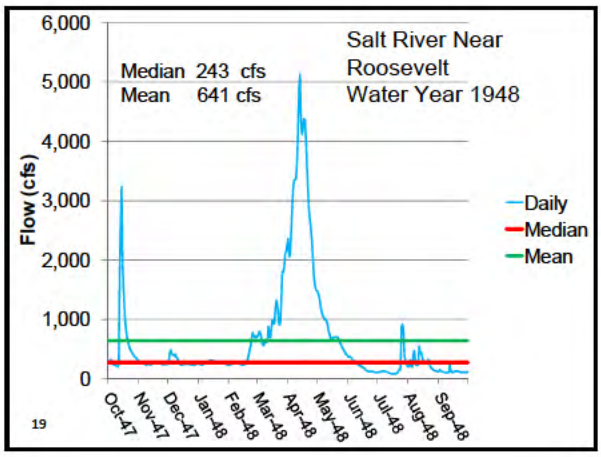
Comparison of 2 Statistical Parameters (CFS)



18

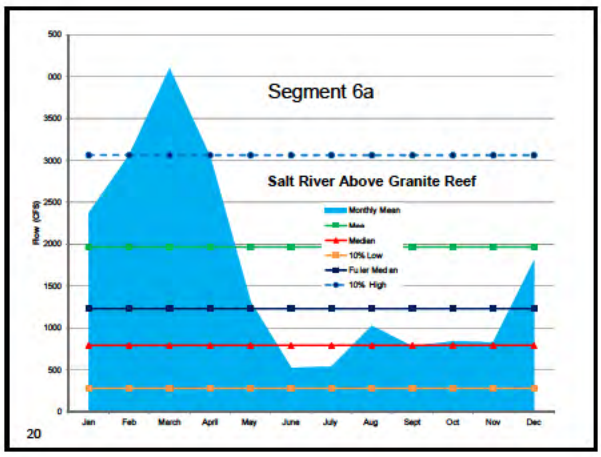
	San Carlos Peridot	San Pedro Palominas	Santa Cruz Nogales	Salt Roosevelt in 100's
daily median	10.0	2.6	2.7	3.4
annual median	32.3	20.9	18.1	7.2



Segment 5

- Fuller's Estimate for Median 992 cfs
- Thomsen's Average Flow for a Median Year (pg.11)
  - 687 cfs
- Gookin Estimate of Median Daily Flow
  - 385 cfs
- Edith's Trip 653 cfs

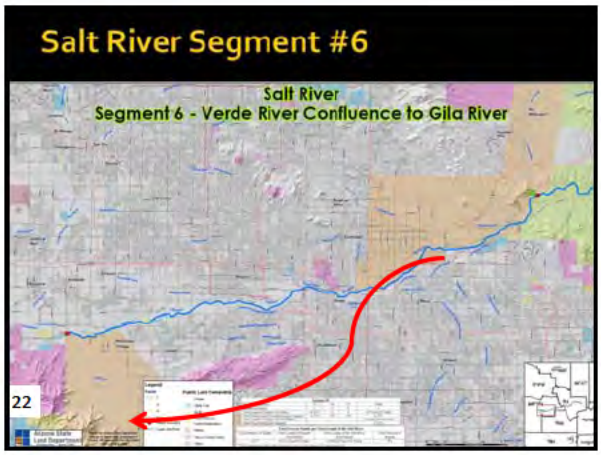
19a

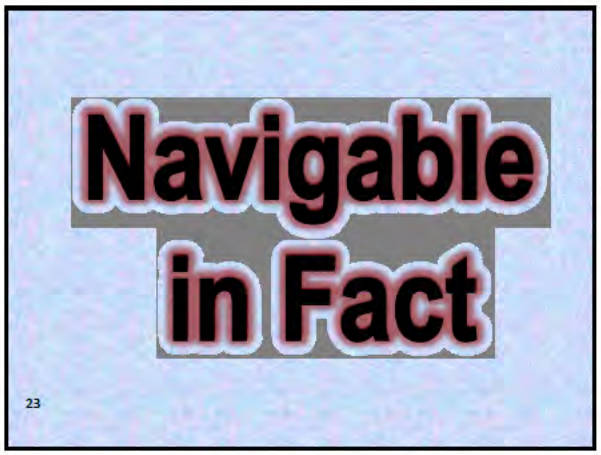


Segment 6B

	Fuller	Gookin Segment 6 A	Gookin Segment 6B
10% High	3062		
Mean		1965	1760
Median	1230	791	581
10% Low or Base Flow	277	296 Gookin Pg 99	86 Gookin Pg 98

21





Montana Decision pg. 21

"…the evidence must be confined to that which shows the river could sustain the kinds of commercial use that, as a realistic matter, might have occurred at the time of statehood."

24

In 1998 Fuller Stated

- "There is no evidence that sustained trade and travel ever occurred on the Lower Salt River, nor is there documented evidence that trade or travel occurred in the upstream direction occurred on the river."
  - Source: Stantech pg v

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Historic Attempts

26

Pre European Occupation

- ❖Pre Hohokam Occupation.
  - ❖No Evidence.
- ❖Hohokam.
  - ❖One rumor of a canoe on a canal.
- ❖Pima.
  - ❖1 failed attempt to cross.
  - ❖Did farm in the Salt River Valley

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Ordinary & Natural Condition

Fuller Slide

- Natural
  - The condition without human impact
  - Not possible to determine condition with zero human impact
  - Is possible to determine condition with no human impacts that significantly reduce or enhance navigability
  - Natural means: without damming & diversion
  - For Arizona Navigability:
    - Winkleman: (Best Evidence: 1800's-1860's)
      - After Hohokam diversions cease
      - Before modern era settlement

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European Occupation

- Spaniards/Mexicans – No evidence
  - They did record when they used boats.
- Trappers – No evidence
  - Pattie did record when he used boats.
- Settlers and U.S. Army

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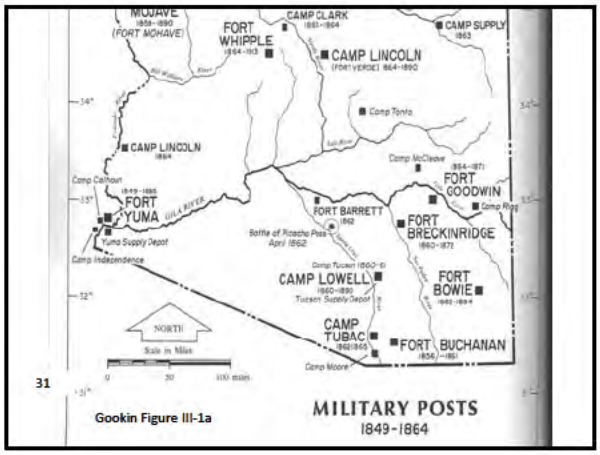
History: Key Findings

Fuller Slide

- Military Posts
  - Camp Reno (1867-1870)
    - Ft. McDowell Outpost
    - On Tonto Creek
  - Camp O'Connell
    - Near Livingston
  - Fort Apache (Camp Ord)
    - On White River
  - Camp Hentig
    - On Black River
  - Fort McDowell (Verde River)

30



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Gookin Figure III-1a

Pre-1867 Evidence Does Not Meet the Winkleman Test

Many of the following examples are the same ones this Commission already determined did not meet the test for Navigability.

32

Upper Salt River

Aka

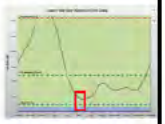
Segments 1-5

33

Historical Boating Accounts

Fuller Slide

- 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



34

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

Historical Boating Accounts

Fuller Slide

- 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

35

Sources: AZ Republican, 10-4-1909

Jim Meadows

- Possibly the same as Burch
- Too vague to tell anything
- Record is a very old recollection
- The boat did not just float off, they built a small downstream obstruction to raise the water levels to get it off.

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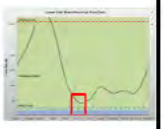
Historical Boating Accounts

Fuller Slide

- 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"



37

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

Burch was already evaluated by this Commission

"Mr. Burch, one of the members of the party, declared that notwithstanding the hazards, he felt that successful log floats down the river could be accomplished. However, the saw mill was never built and no subsequent attempts to float logs were made."

ANSAC Upper Salt River Decision Pg. 38-39

38

Burch

- Reporting was very poor. Different Sources had different stories of same event.
  - "The fish were so thick they floated on their backs."
  - Accounts vary:
    - High centered on rock.
    - Meadows or Meaders.
    - Number of men varies.
    - Losing gear and capzing.
    - Whether they went to Jointhead or Tempe.
  - Unclear as to whether segment 3 was involved.

39

Burch

- Trip was Unsucessful.
  - Upset boat and lost gear.
  - Swift and dangerous rapids.
- In some places water went from wall to wall.
  - No portages.
- In the narrows the canyon was only 11 feet wide.
  - Demonstrates floating logs was not practical.

40

Historical Boating Accounts

Fuller Slide

- Hudson River Reservoir & Irrigation Co (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

41

Sources: Arizona Republican 6-2-1893

Hudson River

- Problems obvious from slide.
  - Occupants thrown into river.
  - Boat severely damaged.
- This was at a time of low flow where the flow "would not push you against the rocks."
- Note that it was so narrow they had problems finding a place to sleep. It took 5 hours even though the river was at low flow.
  - This means portaging is not an option in many places.

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Historical Boating Accounts

Fuller Slide

- 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

43

Sources: AZ Republican, 6-28-1910

ANSAC already rejected

"The rowboat they used was in a very dilapidated condition at the end of the trip. They stated that before the start was made, three bottoms had been placed in the craft and one of these had been worn through by the constant friction of the boulders and sand found in shallow waters. They also stated that many times the men were compelled to lift their craft from the water and carry it over obstacles or portage around rapids and waterfalls. The men were pleased with their adventure but had no intention of attempting to repeat it or to go into competition with the stage company,"

ANSAC Lower Salt River Decision pg. 39

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Thorpe and Crawford

- Demonstrated Commerce was uneconomical by boat.
- Could not compete with a Stage Coach.
- Boat seriously damaged.
- Dragged boat.
  - Fails Montana Test at pg 21-22

"Mere use by initial explorers or trappers who may have dragged their boats in … the river… is not itself enough."

45

Historical Boating Accounts

- Herbert Ensign & Donald Scott (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

46

Sources: Arizona Republican 6-28-1919

Ensign and Scott

- ❑ Recreational.
- ❑ Perilous rapids.
- ❑ After Roosevelt Dam was built flows are not ordinary and natural.
  - ❑ No sudden floods.
  - ❑ River bed downstream armors.
    - ❖ Mannings "n" increases.
    - ❖ Slope decreases making river deeper.

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Ordinary & Natural Condition

Fuller Slide

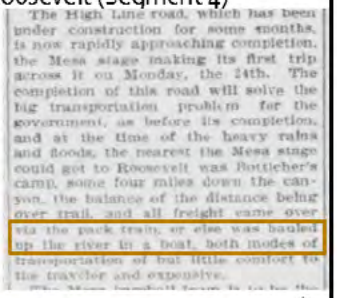
- For the Salt River
  - Identify the major changes to the river system
    - Minimal change upstream of Lake Roosevelt
      - Changes don't significantly impact navigability
      - Some decrease in natural flows
    - Substantive Change Below Lake Roosevelt
      - Reservoirs – river valley inundated
      - Water Supply Management – altered hydrology

48

Historical Boating Accounts

Fuller Slide

- 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.

49

Sources: AZ Republican, April 30, 1905

Hauling Freight

- Not a meaningful distance – 4 miles
- Hauled ˛dra˛˛ed˛ the boats upstream.
- Only attempt upstream

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Segment 6

51

Winkleman

- " [E]vidence of the River's condition after obstructions cause a reduction in its flow is likely of less significance than evidence of the River in its more natural condition and may in fact have 'minimal probative value.'"
  - Paragraph 31

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History: Key Findings

Fuller Slide

Canals

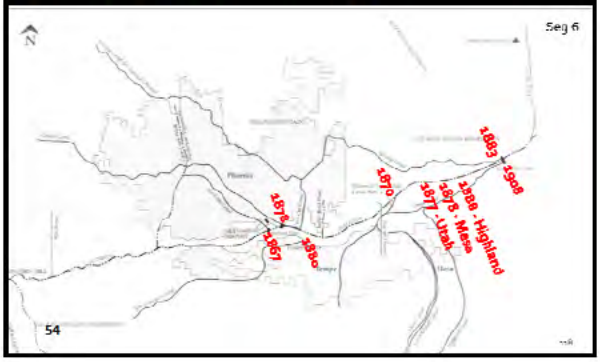
Swilling's (Salt R Canal)	1867	Jointhead Dam
Maricopa Canal	~1870	Jointhead Dam
Tempe Canal	1870	9 mi. upstream JD
Broadway Canal	1870	4 mi. upstream JD
Utah Canal	1877	14 mi. upstream JD
Mesa Canal	1878	16 mi. upstream JD
Grand Canal	1878*	3 mi. upstream JD
San Francisco Canal	1880	Tempe Canal
Arizona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

53

ASLD Table 7-8 (Lower Salt)

History: Key Findings

Fuller Slide



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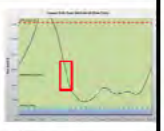
Historical Boating Accounts

Fuller Slide

- Flat Boat (May 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



55

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

Flat Boat

One of the accounts already considered by the Commission at pg. 34. ANSAC Lower Salt River Decision

"In the study prepared by CH2M Hill and updated by J.F. Fuller/Hydrology and Geomorphology, Inc., there are 16 accounts of boating or floating logs or otherwise attempting to use the Salt River for commercial travel between May 1873 and January 1915."

Listed on Table 6 of the Fuller Report 2003 pg. 3-18,19.

56

Flat Boat

✓It is very short and "not a meaningful distance."(Montana Decision pg.24)

✓I measured 2 miles as the crow flies.
✓ Mr. Fuller says 3.5 miles.

✓No idea what the flow was.

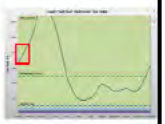
57

Gookin pg. 26

Historical Boating Accounts

Fuller Slide

- 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"



58

Sources: Arizona Sentinel 1-25-1879

Hamilton et.al.

- Not a Commercial trip.
- No evidence that anybody followed up with his conclusion.
- Examination of the article shows daily stage trips, railroad schedules, ads of shipping on the Colorado River elsewhere in the Newspaper.

59

Hamilton et.al.

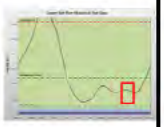
- We have no flow records.
  - The average maximum Temperature in January was 80 de_rees in Yuma that _ear. T_ _ical of March.
  - Littlefield - 2 weeks later Gila River considerably swollen.
  - There was an early snowmelt.
  - Gookin pg. 26-28

60

Historical Boating Accounts

Fuller Slide

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



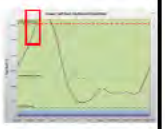
61

Sources: Arizona Republican 10-2-1920

Historical Boating Accounts

Fuller Slide

- 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



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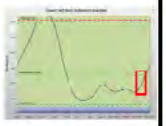
AZ Gazette, 2.17.1881

Historical Boating Accounts

Fuller Slide

- "Yuma or Bust," November 1881
  - Segment 6 (Phoenix to Gila River)
    - Then Gila River to Yuma
  - 20 x 5 ft flatboat
  - Shallow flow, sand bars
    - Knee deep flow
  - Buckey O'Niell



63

Source: ASLD Report, Phoenix Gazette (11.30, 12.3.1881)

Yuma or Bust

- Already considered and rejected by the Commission.
- News reports are inconsistent.
- Violates the Montana test about not dragging the boat.

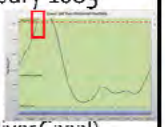
Gookin pg.

64

Historical Boating Accounts

Fuller Slide

- 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"



65

Sources: AZ Gazette, 2-14-1883

Wilcox and Andrews

- Already considered by the Commission and rejected as proof.
- Very wet time of year.
- Rainfall was occurring.
- Very slow progress.
- Recreational - minimal load.
- Only went to jointhead dam.

• Gookin pg. 29-30

66

1885

Arizona Dam

67

Historical Boating Accounts

Fuller Slide

- 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

68

Sources: Phoenix Herald, 12-12-1888

Spaulding

•Already considered by the Commission and rejected as proof.

•Very short reach.

•Brush dam is much like a Beaver Dam.
–They were removing supplies to lift the canoe over.

• Gookin pg. 31-32

69

Historical Boating Accounts

Fuller Slide

- Gentry & Cox (Jan 9, 1889)
  - Segment 6
  - Large Ferry Boat, Five men
  - Maricopa Crossing
    - Intended to go to Gila Bend
  - After reaching Gila River
    - 40 miles downstream of Phoenix
    - Boat snagged in high current & broke apart

70

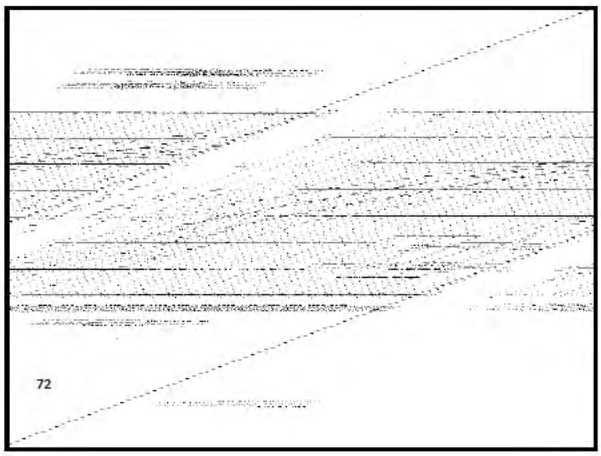
Sources: Tombstone Daily Prospector, Jan 24, 1889

Gentry and Cox

- "...we produce the following account of a wreck".
- Water was flowing at 15 miles per hour.
  - (22 feet per second) .
  - Obviously a huge flood or misreported.
- Maximum flow was 24,953 cfs.
- Mean flow was 5,947 cfs
- The USGS shows only about 2,000 cfs on that day (January 9)

• Data for last 3 bullets from USGS WSP2 pg .35,37

71

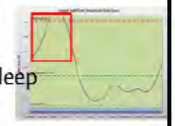


72

Historical Boating Accounts

Fuller Slide

- 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



73

Source: Coconino Sun, 9.7.1945

Sykes

- Fifty years after the fact.
- The Winter of 1890 was very wet
- Many unknowns.
- Recreational.
- Had to carry or drag the boat.
- The boat capsized.

• Gookin pg.33

74

Historical Boating Accounts

Fuller Slide

- 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

75

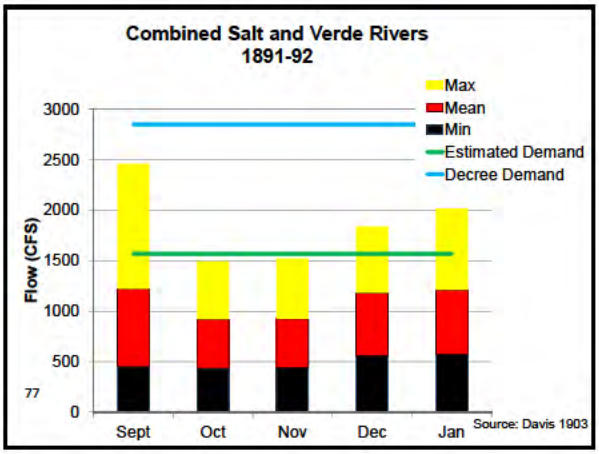
Sources: Arizona Sentinel 4-2-1892

JK and George Day Trips

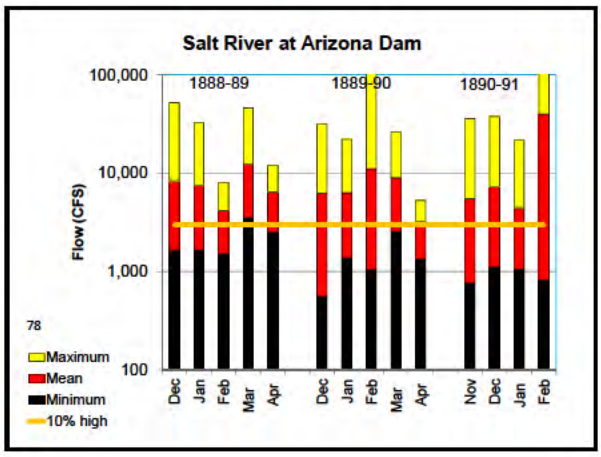
- No indication of how they got down the Salt in 1891-92.
- Boat was small and would have been heavily loaded.
- Entered the Salt River.
- Report gives no details on when in the 6 months they boated.

• Gookin pg. 33-38

76



77



Historical Boating Accounts

Fuller Slide

- 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

79

Sources: Bisbee Daily Review 10-6-1909

Lieutenant Robinson

- ❖Hearsay on Hearsay.
- ❖Many Unknowns.
  - ❖When.
  - ❖Cargo
  - ❖Route.
  - ❖Point of beginning.
- ❖16 year old recollection.
  - ❖ Gookin pg. 38

80

Historical Boating Accounts

Fuller Slide

- 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

81

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

Adams and Evans

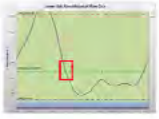
- Already considered by Commission and rejected.
- No Source Disclosed.
- Fuller –" No Records of unusually high flows in February."
  - January USGS shows
    - 79,806 cfs Maximum.
    - 9,897 cfs Mean Average.
  - February
    - 3,697 cfs Maximum.
    - 3,061 cfs Mean Average.
  - Gookin pg. 39

82

Historical Boating Accounts

Fuller Slide

- Floating Logs, May 1894
  - Lumber from Ft. McDowell post retirement
  - 300 cords of lumber placed in river
  - Scheme abandoned due to threat to Arizona Dam in Salt River Segment 6



83

Sources: The Salt Lake Herald, 5-3-1894
Cited to Scott Solliday in ASLD Reports

Floating Logs

✓Already Considered and Rejected by Commission.

✓Scott Soliday historian at Tempe Historical Museum told Douglas Mitchell.
- ✓Mr. Soliday told Mitchell the source was 1890 or 1891 not 1894.

✓Based on the brief article it appears the wood went nowhere. It is expected to show up in the Salt River in the next flood.

84

Historical Boating Accounts

Fuller Slide

- Jacob Shively & "Capt." Schreiver (March 1905)
  - Segment 6
  - Shively/Shibely
    - 76 years old
  - Built a boat to travel Phoenix to Yuma
    - Keeled wooden boat
  - Launched Phoenix 3/23
  - Sited at Arlington (3/24) & Buckeye (on Gila)
  - Boated a moderate sustained flood – 21,000 cfs
  - Modified boat design en route
    - Added freeboard
  - Reported no problems on Salt River (Day 1)

85

Sources: AZ Republican 3-24,29, 4-3-1905

Shively

- ❑ Tongue in cheek.
- ❑ High Flows.
  - ❑ Salt @ Roosevelt
    - ❑ 9.895 to 6,000 cfs
  - ❑ Verde @ McDowell
    - ❑ 5,594 to 2,770 cfs
  - ❑ Gila @ Dome
    - ❑ 16,000 to 9,500 cfs
- ❑ One person nearly drowned.
- ❑ Lost nearly all their supplies.
- ❑ Boat was partially submerged in the Salt River.
  - ❑ Gookin pg. 40-41

86

Historical Boating Accounts

Fuller Slide

- Flatboat Trip Advertisement (May 23, 1905)
  - Seeking participants for hunting, boat trip
  - Phoenix to Yuma (Segment 6 of Salt River)
  - Leaving Wednesday or Thursday (May 23rd = Tuesday)

87

Sources: Arizona Republican 5-23-1905

Historical Boating Accounts

Fuller Slide

- Reclamation Service Engineers (Dec, 1905)
  - Fowler, McDermott & McClung
  - Arizona Dam to Consolidated Canal
    - Segment 6
  - "Shipwrecked twice" in a mile, no loss
    - "Hit on a rock in a rapid"
    - "Stuck on a sandbar"
  - Once, "threatened to turn over," (but didn't)

88

Sources: AZ Republican 11-9-1905

Historical Boating Accounts

Fuller Slide

- Tom Rains, Boat Theft (April 28, 1909)
  - Segment 6
  - Mr. Rains "keeps a boat on the river near 7th Avenue."
  - Boat was stolen by children (~ 10 yrs old)
  - Boated 9 miles downstream
  - Boat tied up on river bank

89

Sources: Arizona Republican 4-29-1909

Rains

- Recreational only, i.e. a joy ride.
- No supplies.
- Very short.
- Flows were not ordinary.
  - Verde below Bartlett.
    - Avg 1,258 cfs.
  - Salt at McDowell
    - Avg 3,945 cfs.

90

Source: USGS – WSP 1313

Historical Boating Accounts

Fuller Slide

- Louis Selly, Boat Builder June, 1909
  - Master boat-builder
    - Recently completed two boats
    - Orders for "two or three" more
    - "Apt to be kept busy for some time"

91

Sources: Arizona Republican 6-27-1909

Louis Selly

- Two Reasons for building boats
  - Fuller pointed out in 1998
    - "Recreational boating became popular on man-mad lakes starting in the 1880s" pg .33
      - Walnut Grove Reservoir
      - Lake Mary near Flagstaff
      - Lake Rogers near Flagstaff
      - Granite Dells Lake near Prescott in 1907 [all pgs. 27-28]
    - "and accelerated with the construction of … Roosevelt" pg. 33
      - Source: Stantech

92

Historical Boating Accounts

Fuller Slide

- George Greenwald, February 1908
  - "Raft of Lumber" on Salt River (Segment 3)
  - Floating on river current to dam
  - Swept into current around dam construction
  - Greenwald Drowned trying to save lumber
- Two Engineers, 1909
  - One Drowned in Tunnel Impoundment

Sources: Rogge et. al., 1994
AZ Republican 2-14-1908
Zarbin, 1984

93

Construction of Roosevelt Dam

Fuller Slide

- Why Weren't Dam Construction Activities Supplied Up- & Down-River on the Salt?
  - Salt River conditions above Verde River (rapids/riffles, flow velocity, flow depth) not conducive to heavily loaded, deep draft boats.
  - River was going to be shut off – alternative modes of transportation would be required eventually after completion of the dam.
  - Sometimes, they were (AZ Republican 4-30-1905)
  - Logs, lumber were floated downstream to dam

94

Roosevelt Dam

- Misstatement that River was to be shut down.
  - Roosevelt started producing power in 1909.
  - Power production requires round the clock service.
  - Irrigation releases are year round.

95

Meaningfully Similar

96

Meaningfully Similar

"At a minimum, therefore, the party seeking to use present-day evidence for title purposes must show: (1) the watercraft are meaningfully similar to those in customary use for trade and travel at the time of statehood;…".

Source: Montana Decision, pg 22-23

97

The Montana Decision Cautioned

Modern recreational fishing boats, including inflatable rafts and lightweight canoes or kayaks, **…may be able to navigate waters much more shallow or with rockier beds** than the boats customarily used for trade and travel at statehood. (p. 23) [Bold added]

98

Fuller in 1998 Confirmed

Commercial recreational rafting started in the 1930s, but developed in the 1970s, on the Colorado River (especially upstream in Utah) and later on the Salt, Gila, and Verde Rivers. **The development of durable small boats** - plastic, fiberglass and other modem types of canoes and kayaks, inflatable boats for single paddlers and for groups - **all contributed to the rising popularity** of river running in Arizona especially **on rivers not previously considered boatable**, or boatable only very rarely because of low water. [Bold added].

Source: Stantech, pg 32.

99

Fuller Also Quoted Arizona State Parks

- "**Boaters** who aren't content to resign themselves to a few days of fun per year on most of the state's rivers **have started using durable plastic canoes and single person inflatables to run them at levels well below what in the past has been considered boatable.**" Stantech pg. 36 [Bold added]

100

Fuller Further Stated in 1998

- "…[R]ivers were not generally used for recreational travel until the development of new materials such as fiberglass and artificial rubber after World War II.
  - Source: Stantech pg 33

101

Fuller Slide

Modern Boating on the Salt River

- Current Commercial Operations – Segments 2-3
  - USFS Permit Season: March 1-May 15 (76 days)
  - Four Commercial Companies
    - Allowed 2 launches per day (total, into Wilderness Section)
    - User Days

	Daily (Seg 2)	Wilderness (Seg 2-3)
Wet Year (2010):	6,950	570
Dry Year (2015):	850	190

> "The Government's assertion as to lack of commercial possibilities fails to appreciate the source of commerce which [the] future will undoubtedly develop to a considerable extent-the use of these [r]ivers for the transportation of tourists for hire, to view the natural scenic wonders and explore the archeological features of these regions."
> Utah Special Master's Report, p. 117.

102

Source: D. Sullivan, USFS Tonto River Ranger, 2015

Utah Special Master pg. 117

"As to the phrase 'customary modes of trade and travel on water,' as used by this Court in its test of navigability, I understand it to mean that the modes of transportation must be such as are customarily used in rivers at the date involved …".

103

Utah Special Master pg. 117

- Boats Listed
  - Rowboats
  - Motorboats
  - Barge
  - Rafts (limited reaches)
- Boats Not Listed
  - Canoes
  - Inflatibles
- Fuller confirms canoes were not considered in 1998. See Stantech pg. 23, 42

104

Canoes

- Not a "Customary Mode of Trade and Travel"
  - Utah Special Master did not consider canoes
  - Examples do not use canoes
    - Pattie
      - Used canoe on San Pedro and Colorado Rivers only. San Pedro was in an extraordinary condition.
    - Pictures
      - Sitting in still water
    - U. S. Army
      - Built canoes and used them for ferries but not transport
    - Kentucky's Salt River Gookin pg. 78-82

105

Fuller 1998

- In his listing of "Boat Types in Arizona before 1913"
  - Canoes are for "Lakes and calm rivers for fishing, recreation, travel"
- "When determining boatability, the intended kind of boat and purpose need to be considered. A river that is boatable by a neoprene raft or fiberglass canoe may not be boatable by wooden rowboats, for example."
  - Source: Stantech, pg 31, 33

106

Newer Canoes

- Fiberglass handles 30,000 psi.
- Cedar handles 920 psi.
- Aluminum handles 40,000 psi.
  - Were not available in 1912.
  - Virtually replaced wood canoes.

107

Gookin-Santa Cruz Rpt Chpt VII pg 2
Gookin pg. 68

Fiberglass Canoes Figure IV-1 Source: USDA

108

Aluminum Canoe Figure IV-2 Source USDA

109

Canvas Canoes

- Lacked Hydraulic lines.
- Canvas canoes are different than back them.
  - Canvas is different.
    Coatings are different.
- No indication that they were "Customary Modes."
- Fuller 1998 – table of "Boats Available."
  - "Hunting in calm water."
    - Gookin pg. 70-71

110

Modern Canvas Canoe Source: Old Town Canoe

Old Canvas Canoe Source: Fuller 2015a Slide 149

Figure IV-3

111

Fuller 1998

"When determining boatability, the intended kind of boat and purpose need to be considered. A river that is boatable by a neoprene raft or fiberglass canoe may not be boatable by wooden rowboats, for example."

Source: Stantech, pg 33.

112

Royalex

- Material of Mr. Fuller's canoe used for the demonstrations of navigability. Revolutionary advance compared to Fiberglass and Aluminum.
- Ads show it being thrown of factory roofs and falling out of planes and surviving.
- It can be folded almost in half and bounce back.
  - Gookin pg. 75-78

113


ABS it bends, but never breaks!
114
https://www.youtube.com/watch?v=wlkfnxLBCZ8
0:03 / 1:02


115


116


117


119

120

Rafts

- Wood
  - Allows one way trips.
  - Hard to control.
  - Structure is weak.
  - No evidence of current use.
  - Little, mostly unsuccessful use at or before statehood.
- Rubber
  - Carbon Black.
    - Discovered 1904.
    - Increased tensile strength 1008%.
  - Artificial Rubber
    - Fuller 1998.
    - "Use of inflatables , however, did not become common until the development of artificial rubber in the 1940's." (Stantech pg.22)

Gookin pg 62-65

121

Fuller Slide

Modern Boating on the Salt River

122

Wood

- Relatively weak. Gookin pg. 74-75
- Expensive
  - A 16 foot canoe (Sears) was $1,282 (in current dollars).
  - Freight canoes were larger.
- No evidence presented of two way travel.
- Limited load. Fuller estimates 500 lbs capacity.
- Cost to abandon canoe was $1.10 per ton-mile plus other costs versus 23-35 cents per ton-mile for wagons.

123

Modern Recreational Boating

- Fuller indicates that upstream of the Roosevelt Dam Reservoir the river is in its "Ordinary and Natural" condition.
- This means the decision of ANSAC made in 2007 for the Upper Salt River stands as valid for the portion of the Salt River upstream fo the Roosevelt Dam Reservoir.

124

Ordinary & Natural Condition

- For the Salt River
  - Identify the major changes to the river system
    - Minimal change upstream of Lake Roosevelt
      - Changes don't significantly impact navigability
      - Some decrease in natural flows
    - Substantive Change Below Lake Roosevelt
      - Reservoirs – river valley inundated
      - Water Supply Management – altered hydrology

125

ANSAC Ruled

- "Since the 1950's, using modern neoprene and rubber boats, individuals and organizations have been conducting float trips from the Salt River Canyon down to Roosevelt Lake. These trips are strictly recreational in nature in order to view the scenery and wildlife, enjoy the excitement and danger of white water rapid running and perhaps do some recreational fishing." (continued next slide)

126

ANSAC Decision (Continued)

- " These trips occur in later winter and spring and are not use of the River as a highway for commerce over which trade and travel are or may be conducted in the customary modes of trade and travel on water as of February 14,1912."

ANSAC Decision on the Upper Salt River 2007 pg 62

127

Susceptible to Being Used

128

Demonstrating Susceptibility Takes Two Steps

1. "[B]ut, where conditions of exploration and settlement explain the infrequency or limited nature of such use,
2. "the susceptibility to use as a highway of commerce may still be satisfactorily proved."
   - Winkleman pg 30

129

Fuller explains

- "Faulty Logic: If the river was navigable, people would have regularly boated it." [Fuller 2015a Slide 68—Boating in Arizona (Verde) Powerpoint
- Navigation probably occurred but was so common it was not reported.
- When there was water there were no people who needed commerce. When the people were present there was not water.

130

Faulty Logic

- Historically, navigation has driven trade until the Railroad.
  - Major cities were located on sea ports or rivers.
  - Trade is essential to civilization.
- Why, because travel by boat is cheaper and faster.

131

Erie Canal

- It took eight years to dig. Opened in 1825.
- It was 40 feet wide and 4 feet deep.
  - Not 6" deep.
- It was built by physical labor and animal power.
- Prior to the Erie Canal Freight cost 27.5 cents per ton-mile; afterwards 1.6 cents per ton-mile.
- Spawned an entire network on canals.

132

Source: University of Texas Austin – Perry-Castaneda Library Map Collection

Cost Estimates

- Three estimates of wagon costs per ton mile
  - 23 cents; 26-35 cents: & 27.5 cents
  - (see attached sheet for sources)

134

Gookin Report pgs. 45-52

- Numerous Sources explaining the importance and economic benefits from navigation.
- The Army found:
  - "Travel inland from the [Colorado] river still required a difficult and time-consuming journey by horse or stagecoach, one made worse by the poor condition of the few existing roads." [Pry and Andersen, pg. 14]

135

"Ordinary and Natural"

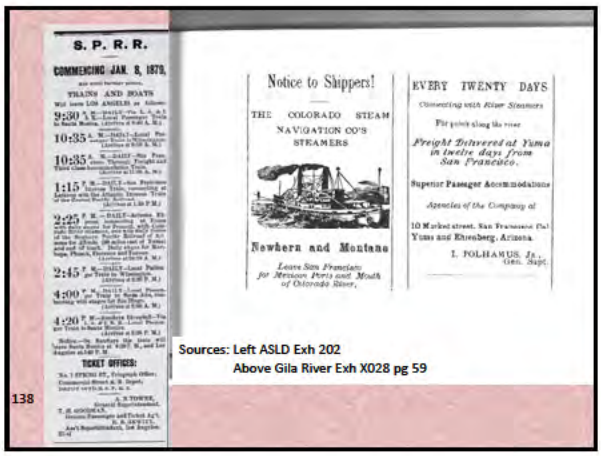
- Erie canal had to be built at great expense.
- Wagons require roads to be built, obstacles removed or bridged.
- A River that is Navigable in its "Ordinary and Natural" only requires a boat.

136

Navigation probably occurred but was so common it was not reported.

- The commencement of a commercial service would have been announced.
- The continuation of a commercial service required advertisements.
  - Yuma papers had advertisements showing times and dates of departure, locations of departure, and rates

137



Sources: Left ASLD Exh 202
Above Gila River Exh X028 pg 59

138

Too Few People for Navigation

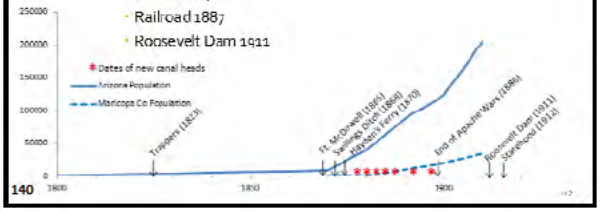
- Yuma experience shows it is wrong.
- When Phoenix began Yuma existed with boats
- Fuller documents the people of Phoenix had boats
- Ignores earlier inhabitants

139

History: Key Findings

Fuller Slide

- Key Events in Salt River History (Seg 5-6)
  - Explorers 1500's-1800's
  - Trappers 1820's
  - Euro-American Settlement 1860's
  - Agricultural Economy
  - Canals 1867+
  - Railroad 1887
  - Roosevelt Dam 1911

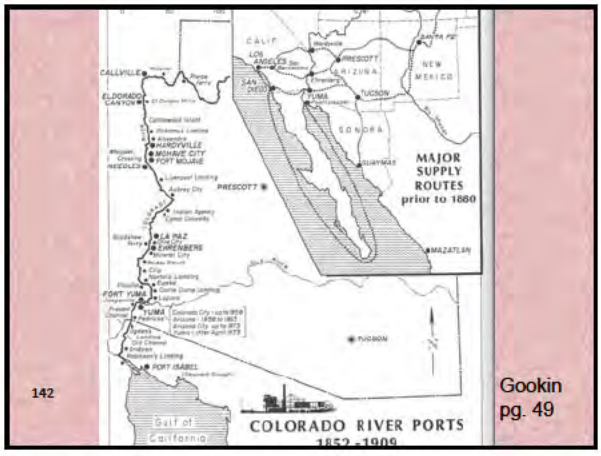


140

Yuma Story

- In 1852 there were boats on the Colorado River based in Yuma
  - San Diego County had 798 people in 1850.
    - Split between the Coast (San Diego) and the Colorado River.
  - Arizona wasn't even counted. It had "very few residents who were not Native Americans."
    - From Gookin pg. 54

141



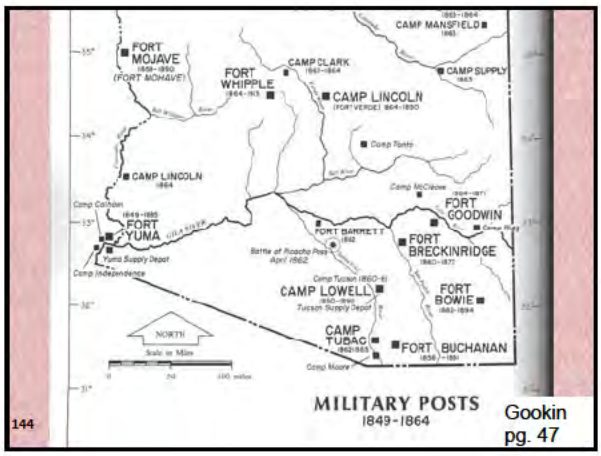
142

Gookin pg. 49

So Why and How Did They Boat

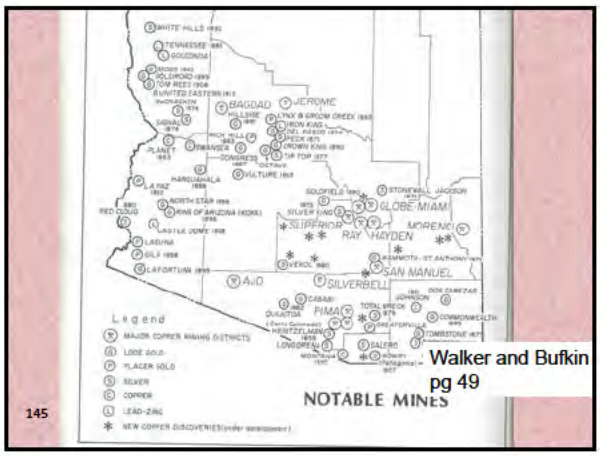
- Why?
  - Military Presence.
  - Mines – In 1857 gold was discovered on the Colorado River.
- How did they manage. Fuller indicates that Phoenix, when it was bigger than Yuma was in 1852, didn't have people who knew how to build a boat or pilot a boat.
  - Fuller in 1998 explained how Yuma did it. "supplying the forts offered new opportunities for boating entrepreneurs." (Stantech pg 24)

143



144

Gookin pg. 47



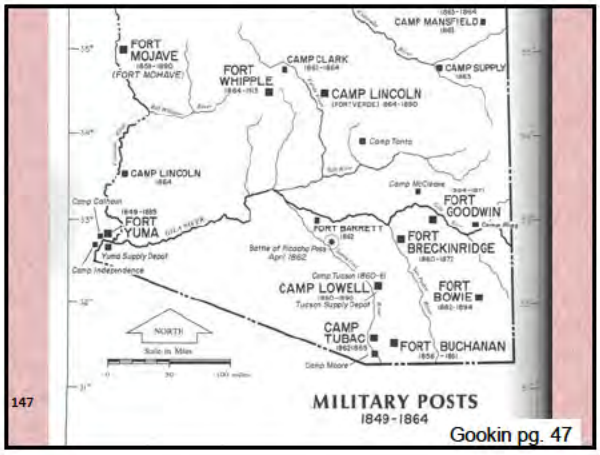
145

Walker and Bufkin pg 49

Salt River Valley Story

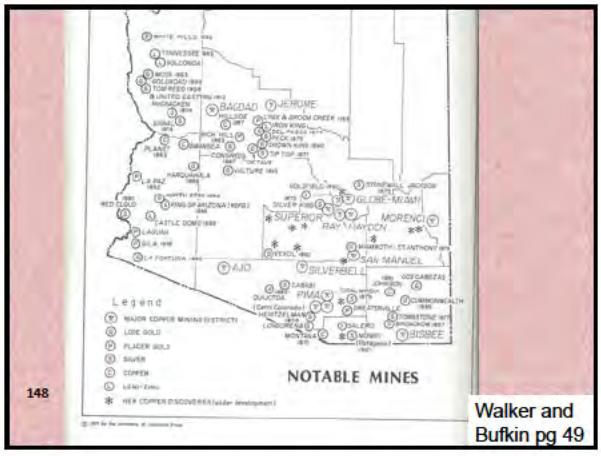
- Beginning in the 1860s.
  - Forts were established on the Salt and its Tributaries.
  - The garrisons of the forts build boats and used them as ferry's not for navigation.
- Beginning in the 1870's mines began upstream from the Valley.
- No Navigation.

146



147

Gookin pg. 47



148

Walker and Bufkin pg 49

Beginning in 1858

- Stagecoach lines were built to cross Arizona
  - 1858-1861 (Walker and Bufkin pg. 41)
  - Stagecoach lines ran to Phoenix by 1872 (Trips into History)
- Enough people for a stagecoach line in 1872.
- Stagecoaches require a road, vehicle, stations along the route, and lots of horses.
- A River requires a boat

149

Stagecoach Rides Were Awful

- Packed Three Across.
- Had to interweave their knees.
- Dust was unbelievable.
- Ran 24 hours a day.
- You slept sitting upright.
- You were fed quickly at the stage stops.
- Motion sickness was common.

150

In 1877 the Railroad Arrived

- It got to Yuma.
- The State Legislature and Maricopa County acted.
- Passed bonds to build roads to get products to Yuma.
- It did not encourage boat building.
  - Gookin pg. 50 - 52

151

As the Railroad Advanced Along the Gila River

- At no point did passengers disembark to take the boat to Salt River Valley.
- Instead they got off at Maricopa and took the Stagecoach 35 miles to Phoenix.
- Stagecoach rides were awful.
  - Gookin pg .50-52

152

Yuma Already Existed

- Yuma had river craft.
- Yuma had experienced river pilots.
- Yuma had port facilities.
- Yuma was supplying forts and mines on the Colorado River.
- Yuma did not send boats up the rivers.
  - Gookin pg. 55

153

Even if Yuma Did Not Exist

- Fuller in 1998 pointed out that lots of boats existed. (Stantech pg. 25)

154

Native Americans Had Population

- Pimas had 4,117 in 1858. (Gookin pg. 56)
- Pimas were friendly to the United States.
- Maricopas the other half of the Confederation had come from the Colorado River where boats were used.
- The Pimas and Maricopas did not use boats for their trading.

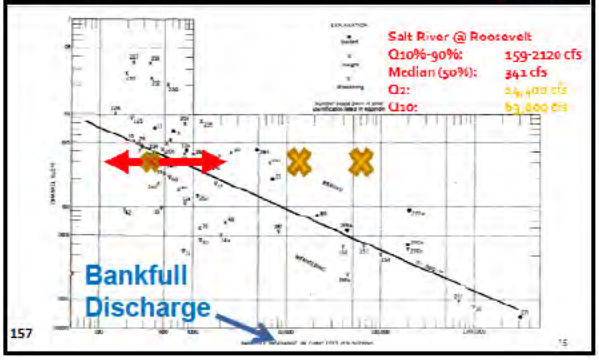
155

Channel Shape

156

Terminology

Fuller Slide Modified



157

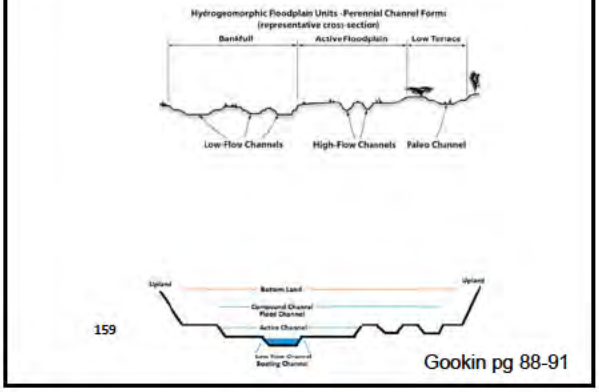
Terminology

Fuller Slide

- US Army Corps of Engineers:
  "...the most common channel type in dry regions, compound channels are characterized by a single, low-flow meandering channel inserted into a wider braided channel network."

Source: Lichvar & McColley, p. 8, (cited in Gookin, 2014, p. 12)

158



159

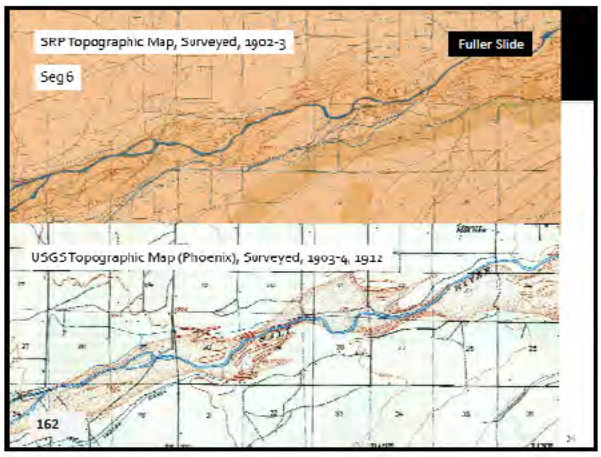
Gookin pg 88-91

Figure 5. Compound channel with a low-flow feature in the foreground, Mojave River, CA.

160

Gookin pg. 92

161



1902-1904

- These were exceptionally dry years
- Diversions were extensive
- Just a trickle would be flowing
- Very wide bed must be filled before much increase in depth can occur

163

The Condition of the Channel Matters

- Montana Decision pg 22-23

"At a minimum, therefore , the party seeking to use present-day evidence for title purposes must show:…(2) the river's post statehood condition is not materially different from its physical condition at statehood."

165

Terminology

Fuller Slide

- Channel Pattern: Relevance to Navigability
  - Minimal
  - Braided, Meandering, Compound rivers can all be navigated if…
- The Real Question:
  - Is the flowing part of the river deep & wide enough to float boats?

166

Depth

167

Modern Recreational Criteria

- Depth
  - Criteria are to be applied to the cross section having **the minimum depth.**
    - See Cortell . .... I pg. 21.
    - See Hyra pg.3.
- Does not consider loads associated with commerce or long trips.
- Based on trying to be thrilling.

168

Not Conveyance

Criteria are based on thrills

169

Gage Measurements

- The Salt River is a pool and riffle river.
- The gages measure in pools.
- They are far deeper than the minimum depth cross-section.
- No consideration is given of minimum widths of 25 feet. (Cortell pg. 21)
- Based on the historical accounts the canyons are sometimes narrower than 25 feet.

170

Utah – Special Master

- Fuller explained in 1998
  - In U.S. v Utah extensive research was done into past boating on the Colorado River and its Utah tributaries. Man . . eo. le who had boated the rivers appeared as expert witnesses. (Stantech pg. 39)
  - As a result they "Researched previous legal decisions, with emphasis on the Utah Riverbed Case (1930). (Stantech pg.4)

170a

Utah – Special Master

- Considered the "Customary Modes of Travel" as of 1896.
- Determined a Mean Depth of 3 was required.
  - Draw does not equal depth required.
  - Rivers vary in depth.

171

Salt River Rating Curves
USGS Gaging Stations: Chrysotile

Fuller Slide

October 6, 2015 @ 330 cfs

172

Salt River Rating Curves
USGS Gaging Stations: Chrysotile

Fuller Slide

October 6, 2015 @ 330 cfs

173

Salt River Rating Curves
USGS Gaging Stations: Chrysotile

Fuller Slide

June 5, 2012 @ 88 cfs

174

Salt River Rating Curves
USGS Gaging Stations: Roosevelt

Fuller Slide

October 6, 2015 @ 550 cfs
Photo taken from USFS boat ramp

175

Salt River Rating Curves
USGS Gaging Stations: Roosevelt

October6, 2015 @ 550 cfs

176

Salt River Rating Curves
USGS Gaging Stations: Roosevelt

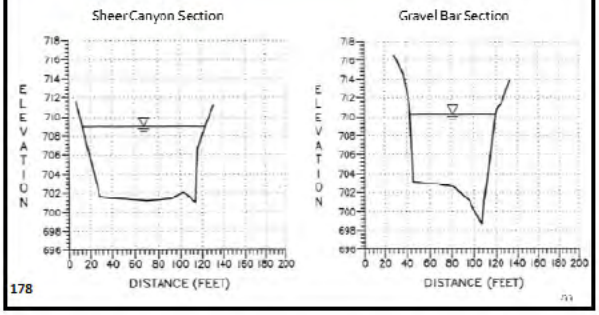
Fuller Slide

June 5, 2012 @ 93 cfs

177

Typical Channel Sections
Segments 1-4

Fuller Slide



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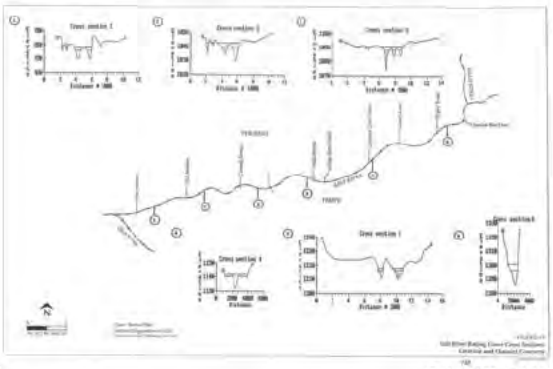


179

Fuller 2003 pg 7-23

Salt River Rating Curves

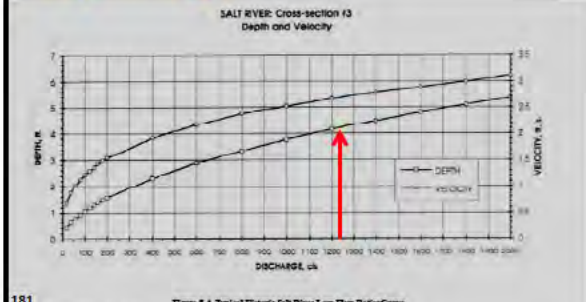
Fuller Slide

- Rating Curves: Flow Depth & Width Estimates
  - Segments 5-6
    - 1907 Topographic Mapping (5 ft. contour interval)
    - Interpolated Low Flow Geometry
    - HEC-2 Modeling - Depth
    - Consistent with Historical Observations

180

Typical Channel Sections Segments 5-6

Fuller Slide



181

Figure 7-4. Typical Historic Salt River Low Flow RatingCurve

ASLD Report, p. 7-25

Representative of Ordinary & Natural Condition, ca. 1905

Salt River Rating Curves

Fuller Slide 238

Modified

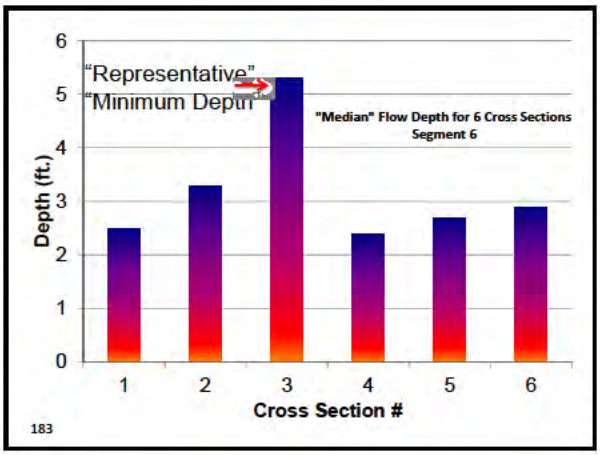
Salt River: Rating Curve Segment 5, Alluvial Channel

Flow Frequency	Flow Rate (cfs)	Avg Depth (ft)	Average Velocity (ft/s)	Top Width (ft)
90%	>159	1.4	1.4	175
50% (median)	992	3.8	2.5	215
10%	>2120	> 5	> 3	> 300

Salt River: Rating Curve Segment 6, Alluvial Channel

Flow Frequency	Flow Rate (cfs)	Avg Depth (ft)	Average Velocity (ft/s)	Top Width (ft)
90%	277	0.8	1.7	205
50% (median)	1,230*	5.3	2.1	290
10%	3,962	> 6	> 3	> 360

182



183

Other Problems

- I used the erroneous 1230 cfs for median flow.
- I believe the Manning's "n" used by Mr. Fuller is too high.
- There are problems with the cross sections.
- But first validation.

184

Fuller Slide

Depth Estimate Verification

- Segments 2-3, 5
  - Field visits
  - Boating trips
  - Historical descriptions
- Segment 6
  - Historical descriptions
  - GLO survey notes
    - Ingalls, March-June, 1868
    - Width estimates by triangular: too deep to cross on foot

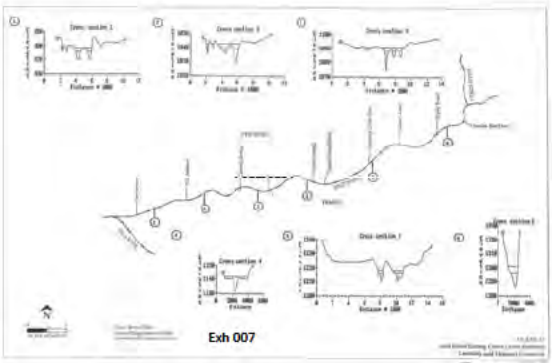
185

Historic Verification

➢None of the historic events support 5.3 Feet

➢Triangulation does not prove depth

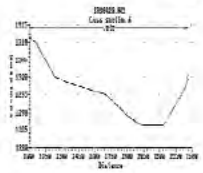
186

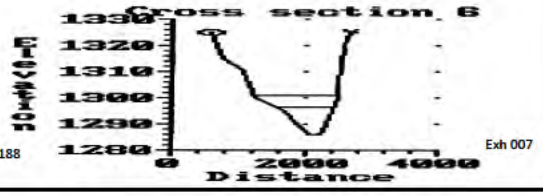


187

Segment 6

Cross Section 6



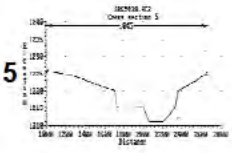


Exh 007

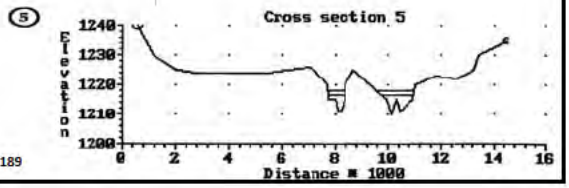
188

Segment 6

Cross Section 5



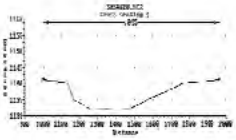
Exh 007



189

Segment 6

Cross Section 4



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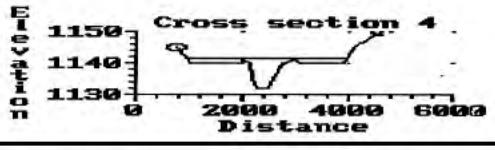
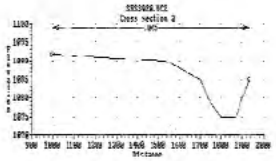


190

Segment 6

Cross Section 3



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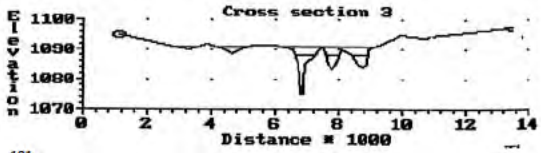

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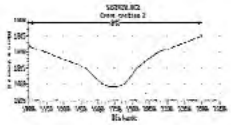
Segment 6 Cross Section 2



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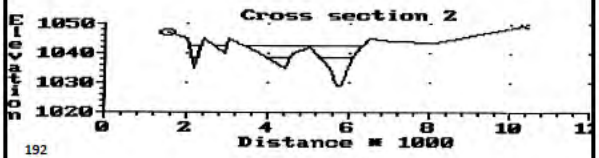
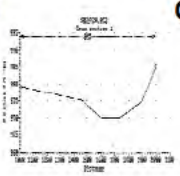


192

Segment 6 Cross Section 1



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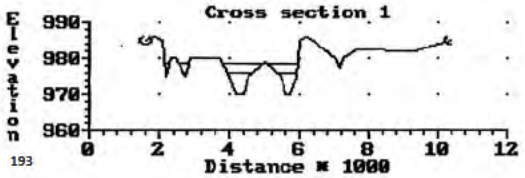

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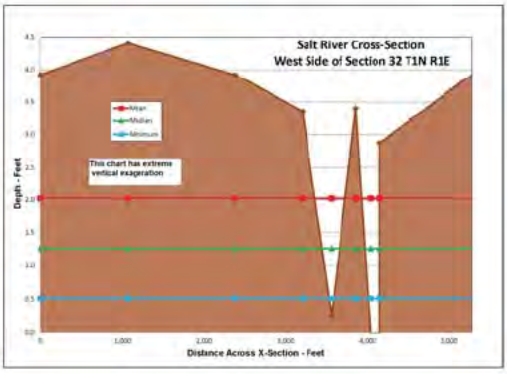


194

Results of Manning's Eqn
Figure VI - 3

	Flow - cfs	n=.025	n=.030	n=.035	n=.045
Mean Depth - Feet					
Mean Flow	1,760	1.04	1.12	1.18	1.33
Median Flow	581	0.69	0.74	0.78	0.86
Minimum Flow	86	0.34	0.36	0.38	0.42
Maximum Depth - Feet					
Mean Flow	1,760	1.87	2.02	2.15	2.39
Median Flow	581	1.16	1.26	1.35	1.50
Minimum Flow	86	0.46	0.51	0.55	0.62
Average Velocity - fps					
Mean Flow	1,760	2.69	2.35	2.09	1.71
Median Flow	581	2.04	1.78	1.54	1.31
Minimum Flow	86	1.27	1.11	0.98	0.81
Width - Feet					
	Flow - cfs	n=.025	n=.030	n=.035	n=.045
Mean Flow	1,760	639	677	710	781
Median Flow	581	414	443	470	514
Minimum Flow	86	202	216	229	252

195

Cooke 107

Other Obstacles

196

Floods

- Monsonal Floods are sudden and fierce
- Leading edge carries large pieces of Debris

197

Marshes

- Existed in Townships 1 N and S Range 1 W.
- Creates vegetation choked areas.

198

Beaver

- In 1867 Ornithologist Coues published that beaver were in the Salt River with Dams "in some places, every few hundred yards."
- Were their dams in the lower Salt River?
  - Beaver want 3 feet of water minimum in their habitat.
  - Marshes may have been remnants of earlier Dams.
  - Dams are there in modern times.

199

Source Gookin pg 117-122

Beaver and Rapids

- Fuller 1998

"Obstacles include boulders, overhanging branches , beaver dams,..."

Source: Stantech pg.37

200

Rapids in Navigable Rivers

- Colorado River only Navigable downstream from the Grand Canyon.
- John Day only had 17 miles out of 250 miles declared navigable.
- Salmon River is not Navigable.

Gookin pg. 123-127

201

202

Edith

- Segment 5 is not in its natural condition.
- Edith's example was at 653 cfs. Median flow is not 997 cfs but 385 cfs.
- Tamarisk has invaded.
- Segment 5's river bottom has been scoured by the Dams' releases.
- Bottom is now cobbles, beer cans, and other garbage.
- Probably has a flatter slope.
- Natural floods rarely occur.

203

Tamrisk Source: Burkam pg 20

204

FIGURE 6.—Saltcedar encroachment along the Gila River between 1932 and 1964. *A*, Looking upstream from the railroad bridge near Calva in 1932; the braided stream probably is typical of the Gila River in most of the Safford Valley in the third and early fourth decades of the 20th century. *B*, Looking upstream from the railroad bridge near Calva in 1964. Leaders indicate: *a*, location of railroad siding at Calva (fig. 4*B*, *C*); *b*, location of alluvial fan shown on plate 4; *c*, location of stream channel in 1964.

River Descriptions

- From Webb, Ribbon of Green
  - p. 314. Citing Minckley, 1973 (p. 121). Commercial fishery on lower Salt (Segment 6)
  - p. 318. USR Segment #5 – dams deprived reach of sediment, making it more cobbly and less vegetated than before dams.

205

Two Impacts

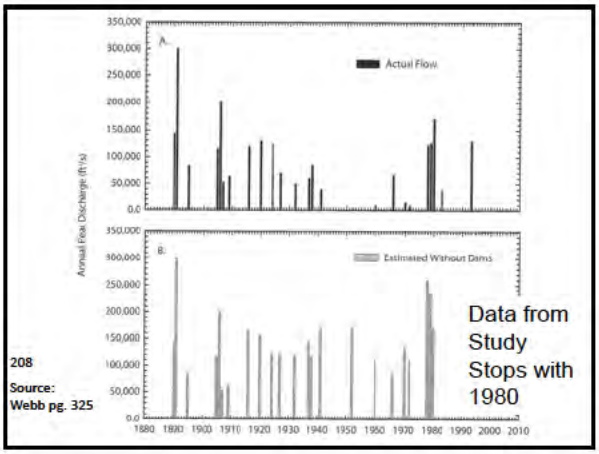
- Roughness
  - Manning's "n" is higher for cobbles than sand and gravel.
  - Manning's "n" is higher yet for bear cans, sacks, and other garbage
- Slope
  - The clear water released scours more at the head than downstream. The river flattens.

206

Montana Decision stated

- "The … expert …at least suggests that as a result of PPL's dams, the river has become "less torrential" in highflow periods and less shallow in low flow periods. App.575–577 (Docket No. 170). Thus, the river may well be easier to navigate now than at statehood."
  - Pg. 23-24

207



Data from Study Stops with 1980

208

Source: Webb pg. 325

Ordinary & Natural Condition

- For the Salt River
  - Identify the major changes to the river system
    - Minimal change upstream of Lake Roosevelt
      - Changes don't significantly impact navigability
      - Some decrease in natural flows
    - Substantive Change Below Lake Roosevelt
      - Reservoirs – river valley inundated
      - Water Supply Management – altered hydrology

209

Montana Decision

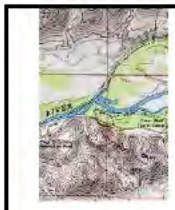
- "As to the river's, the Montana Supreme Court did not assess with care PPL's evidence about changes to …the location and pattern of its channel since statehood." (pg.23)

210

Historical Maps: Segment #5

2011

1904 211



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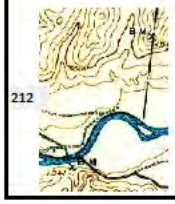

212

213

214

Sept.9,1938
2390 cfs

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

215 Source: Webb pg. 324

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

Jan. 31, 1995
470 cfs
Taken after
1993 Flood

216
Source: Webb pg. 324

Fuller gave an example in 1998

- The construction of Glen Canyon Dam increased the feasibility of commercial recreational rafting, boating, and kayaking through the Grand Canyon by reducing very high flood flows downstream of the dams.
  - Stanteck pg. xi
- It was not until after construction of Glen Canyon Dam that rafting the Grand Canyon became relatively safe and popular for tourists.
  - Stanteck pg. 27

217

Customary Modes of Trade and Travel

- Edith was a boat built for exploration.
- Edith went down the Colorado River before, according to Mr. Fuller, it was safe to.

218

Edith

- Phoenix to Yuma <u>One Way</u>
- 195 Miles load 850 Lbs
- Ton miles 82.88
- $10000 in 1913 $ $416 based on CPI
- Cost per ton mile $5.02 + cost of boating down and walking back
- Three estimates of wagon costs per ton mile
  - 23 cents; 26-35 cents: & 27.5 cents
  - (see attached sheet for sources)

219