

Gila g/M 11-16-05 Jon Fuller/PowerPass &

Gila River Navigability Studies

ANSAC Hearing
November 16, 2005
Phoenix, AZ

Gila River in Arizona



Gila River – West & Central Arizona



Gila River – East & Central Arizona



Overview

➤ Gila River Navigability Study

- Colorado River Confluence to Safford, AZ
- Original Report
 - October 1994 – ASLD
- Revision
 - June 2003 – JE Fuller Hydro & Geo, Inc.

➤ Team Members

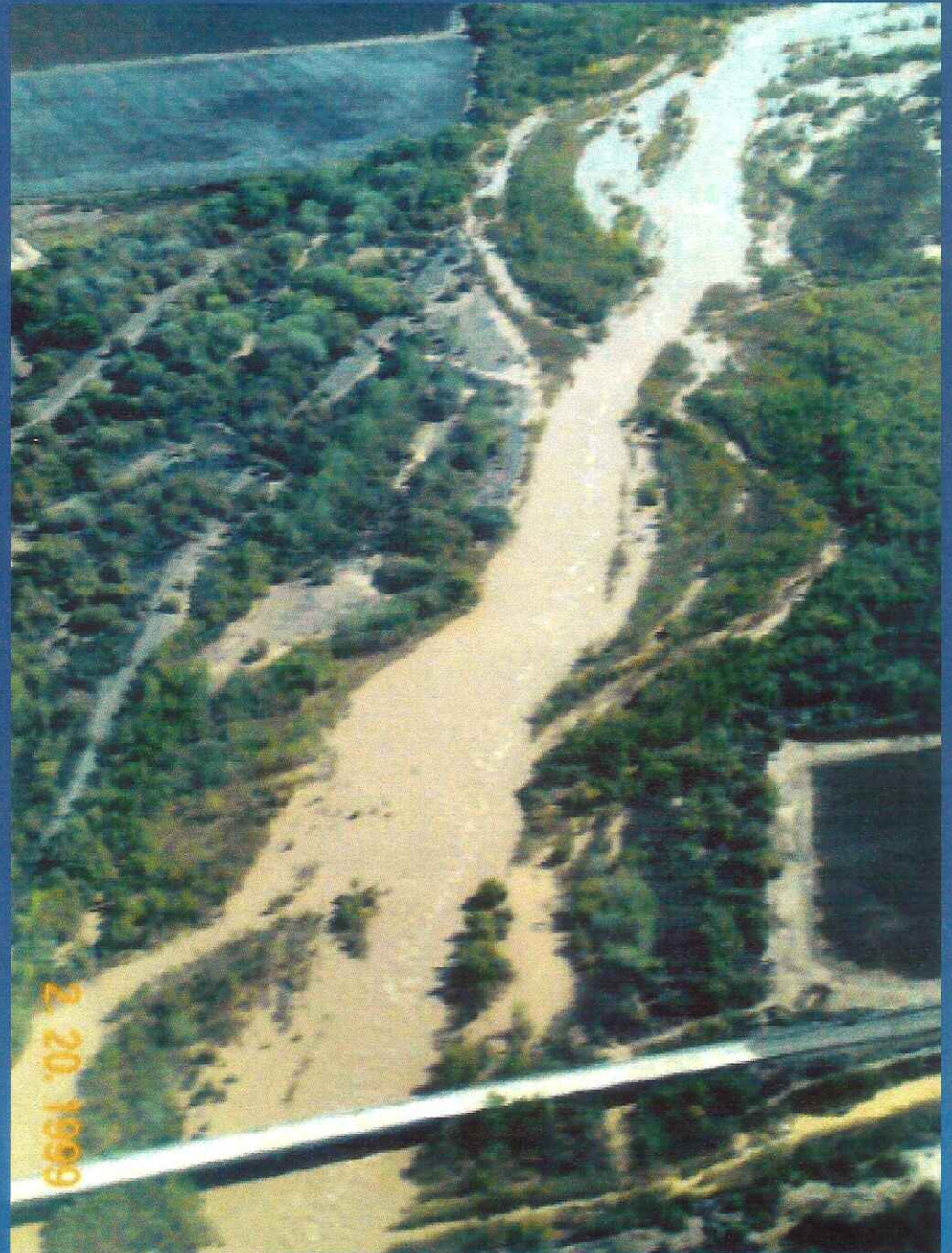
- ASLD – History, Hydrology, Land Use
- SWCA – Archaeology (D. Gilpin)
- AZGS/JEF – Geomorphology (G. Huckleberry)

Overview

- Upper Gila River Navigability Study
 - Safford, AZ to New Mexico Border
 - Original Report
 - GVSCE – June 1997 (Quinn)
 - Revised Report
 - JEF/H&G – June 2003 (Fuller)
 - Team Members
 - SWCA – Archaeology, History, Land Use (Gilpin)
 - JEF – Geomorphology, Hydrology, Report (Fuller)

Overview

- Archaeology
- History
- Hydrology
- Geomorphology
- Land Use
- Boating



Overview

➤ Two Objectives

- Historical Navigation
- Susceptibility to Navigation

Gila River

➤ Archaeological Data Summary

- Irrigation
- Fish
- Population Center

➤ Historical Data Summary

- River Descriptions
- Boating Accounts
- Transportation

Gila River

➤ Geomorphology

- Lower Gila River (Huckleberry)
- Upper Gila River (Fuller)

Historical Geomorphology of the Gila River

by

Gary Huckleberry, Ph.D.
Geological Consultant
Tucson, AZ

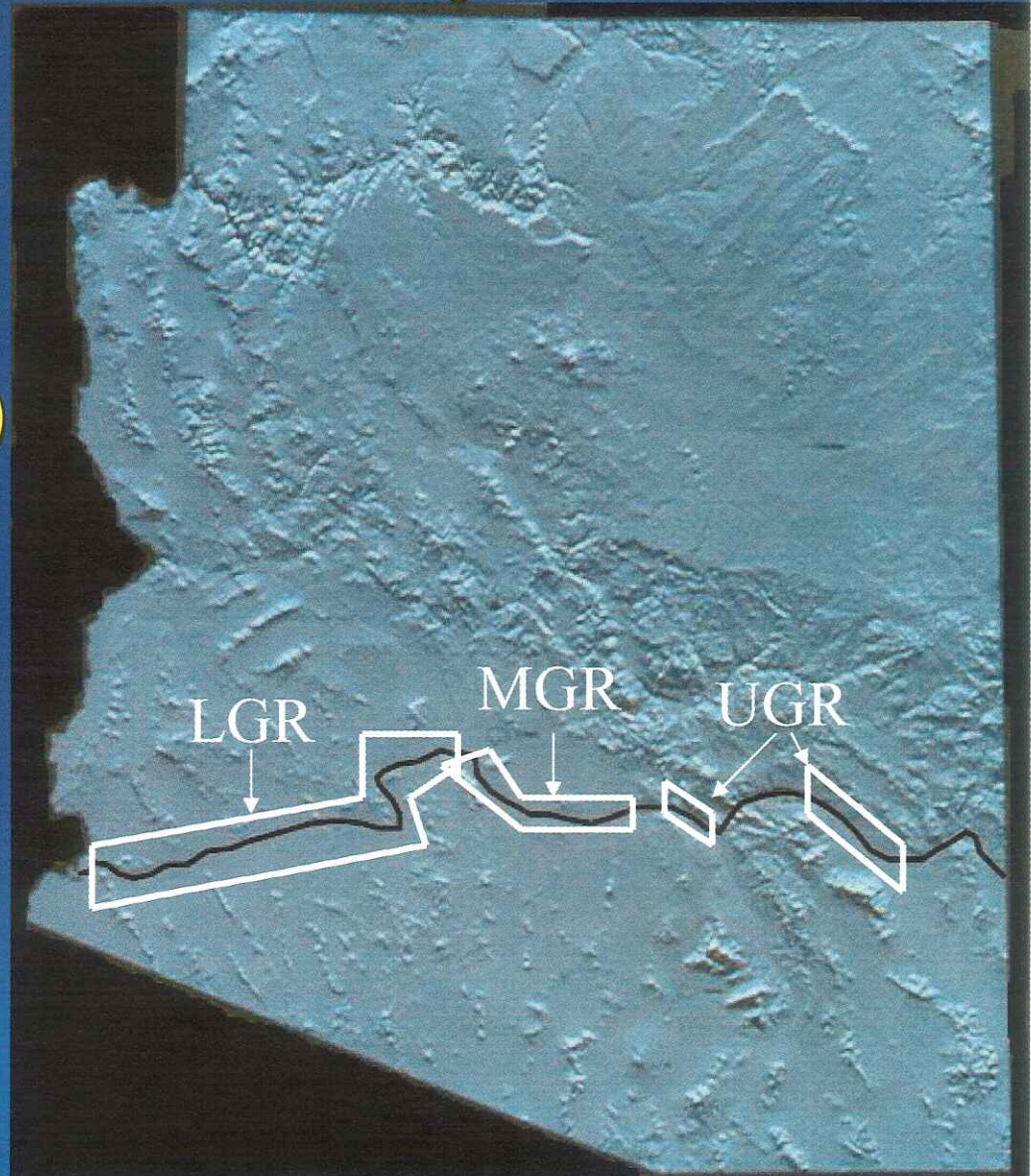
Presented to
Arizona Navigable Stream Adjudication Commission
November 16, 2005

Project Background

- Arizona Geological Survey 1991-1995
- 1993 completed Ph.D dissertation (UA Dept. of Geosciences) on Middle Gila River floodplain history (stratigraphic and archival study)
- 1993 submitted report “Historical Geomorphology of the Gila River”

Gila River Study

- Upper Reach (UGR)
- Middle Reach (MGR)
- Lower Reach (LGR)



Methods

- Archival records (maps, photographs, historic accounts of river)
- Principles of fluvial geomorphology
- Recent river behavior (e.g., 1993 flood)
- Historical channel positions plotted on 1:24,000 USGS topographic maps
- Field Observations

General Observations

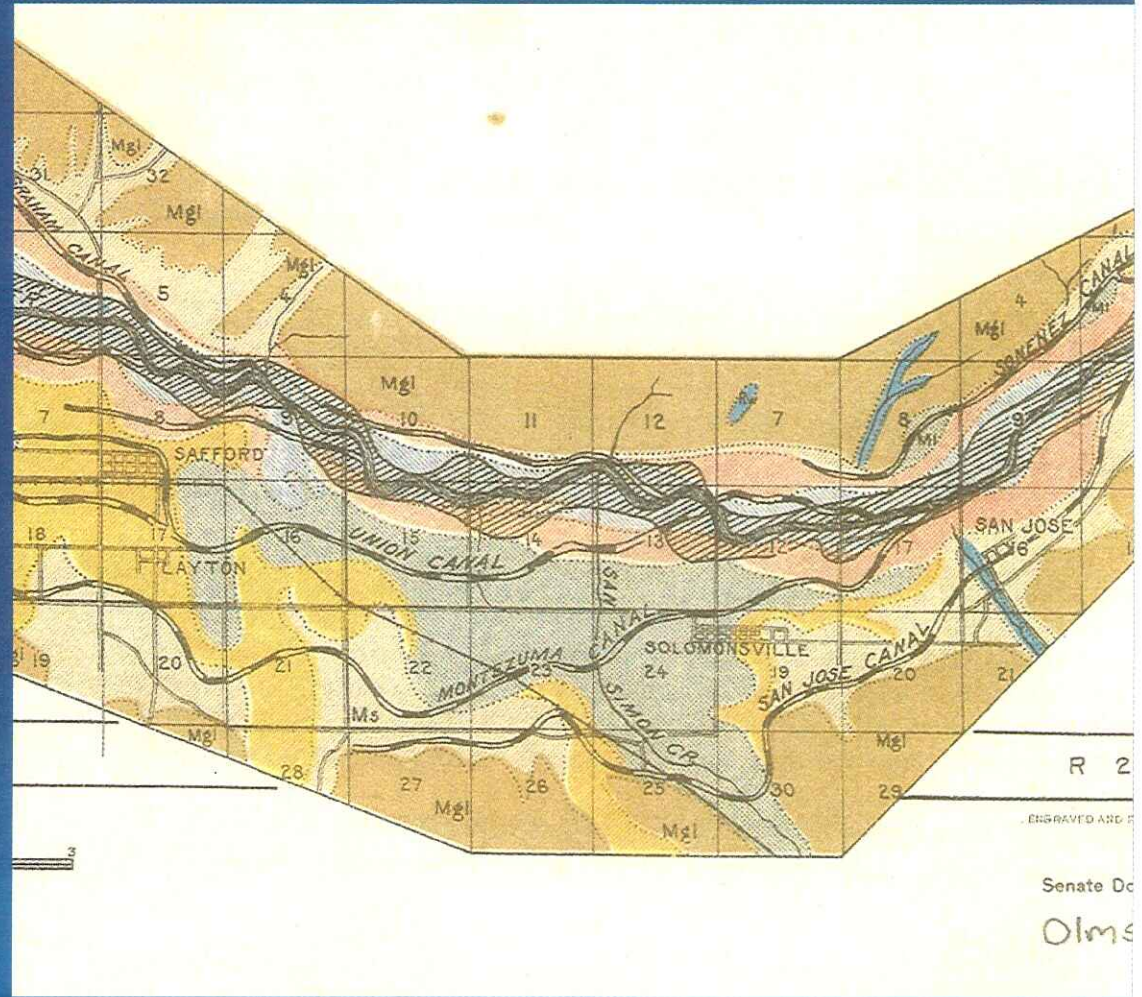
- Channel morphology influenced by history of large floods
- Increases in large flood frequency and magnitude favors wide, braided conditions
- Reduced large flood frequency and magnitude favors narrow channel
- Flood regime changes through time



Gila River at I-10, January 1993

Upper Gila River

- Burkham (1972)
- 1870s: single, narrow channel
- Large floods: 1905, 1906, 1916
- Wide, braided flood channel in 1912



Middle Gila River

- Huckleberry (1993)
- 1800s: GLO surveys
historic accounts
- single deep channel
- Large floods 1905,
1906, 1916
- Wide, braided flood
channel in 1912



Gila River near Sacaton, 1915

Lower Gila River

- 1800s: GLO surveys; conflicting historic accounts
- Wide-shallow vs. deep, narrow, single channel
- Large floods: 1891, 1905, 1906, 1916
- Alluvial reaches: wide, braided flood channel in 1912



Gila River near Wellton, November 1992



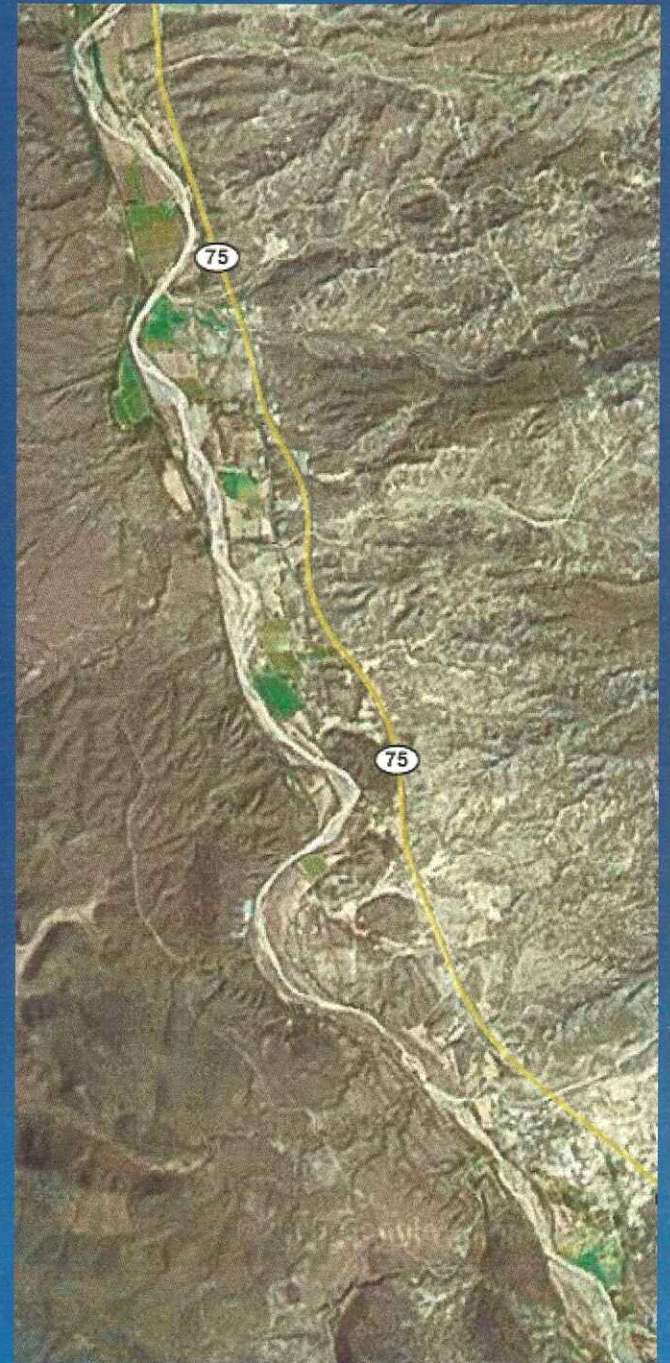
Gila River near Wellton, February 1993

Conclusions

- Gila River has a dynamic floodplain
- 1905-1916 wettest period in at least 3 centuries
- Increased large flood frequency led to wide, braided flood channel along most alluvial reaches
- Between floods, low flow contained within one or more narrower channels

Gila River above Safford

- Gila Box
 - Bedrock Canyon
 - Perennial
- Duncan
 - Alluvial
 - Perennial
 - Sinuous - Meandering



Gila River Geomorphology

➤ Summary

- Variable over Entire River
 - Bedrock Canyons
 - Alluvial Valleys
- Flood Channel vs. Low Flow Channel
- Flood Impacts Significant
- Human Impacts Significant

Gila River

➤ Hydrology

- Lower Gila Flow Rates
 - Perennial prior to diversions & dams
 - Exotic river – upper watershed source
- Upper Gila Flow Rates
 - Perennial
 - Average Annual: 200-430 cfs
 - Median Annual: 70-170 cfs
 - Minimum Monthly Average: 15-100 cfs (June)

Gila River Hydrology

Gauge	USGS ID #	Drainage Area	Earliest Record		Avg Flow
Gila River at Dome	09520500	66,000	1903	1912	1277
Gila River at Buttes Dam Site			1889	1899	630
Gila River at Kelvin, AZ	09474000	18,011	1911	1912	739
Gila River at Coolidge Dam	09469500		1899	1912	272

Gila River Hydrology

Gauge	USGS ID #	Drainage Area	Elevation of Station (ft above MSL)	Slope of Reach	Earliest Record
Gila River Near Red Rock, NM	09431500	2,829	4090	.0015	1904
Gila River Near Virden, NM	09432000	3,203	3,875	.0025	1914
Gila River Near Clifton/Guthrie, AZ	09442000	4,010	3,336	.0019	1910
Gila River at Head of Safford Valley, Near Solomon, AZ	09448500	7,896	3,060	.0031	1914
Gila River at Safford, AZ	09458500	10,459	2,890	.0020	1940

Lower Gila River Hydrology

Gauge	Period Of Record	50% Flow (99% Range)	Average Annual	Min Avg	Max Avg
Gila River at Dome	09520500		455		
Gila River near Sentinel	1912-1917				
Gila River at Painted Rock Dam	1959-1991		345		
Gila River below Gillespie Dam	1921-1991		393		
Gila River at Laveen	1940-1996	0 (0-1390)	63	0	1630
Gila River at Kelvin	1911-1996	270 (0.2-4570)	491	78	3280
Gila River at Winkelman	1917-1991		332		
Gila River at Coolidge Dam	1899-1991		379		
Gila River at Calva	1919-1996	69 (0-4300)	387	29	2450
Gila River at Solomon	1914-1996	179 (30-4300)	474	101	2230

Upper Gila River Hydrology

Gauge	Period Of Record	50% Flow (99% Range)	Average Annual	Min Avg	Max Avg
Gila River Near Virden, NM	1928-1989	91 (3-1800)	190	43	640
Gila River Near Clifton/Guthrie, AZ	1912-1989	80 (9-2000)	206	43	930
Gila River at Head of Safford Valley, Near Solomon, AZ	1921-1989	174 (30-4000)	433	101	1680
Gila River at Safford, AZ	1941-1965	66 (0-3500)	284	87	1120

Upper Gila River Flow Data

Upper Gila River Flow Characteristics				
Frequency	Discharge (cfs)	Depth (ft)	Velocity (ft/sec)	Top Width (ft)
Gila River Near Virden, NM - Upstream End of Study Reach (Duncan Valley)				
90 % Flow	21	0.6	1.3	27
Median (50%) Flow	91	0.9	2.2	45
Mean Annual Flow	190	1.2	1.6	100
Gila River Near Clifton/Guthrie, AZ - Midpoint of Study Reach (Gila Box)				
90 % Flow	18	0.7	1.0	26
Median (50%) Flow	80	1	1.7	47
Mean Annual Flow	206	1.3	2.5	64
Gila River at Safford Valley, Near Solomon, AZ - Downstream End of Study Reach (Safford Valley)				
90 % Flow	62	0.8	0.5	144
Median (50%) Flow	174	1.3	0.9	146
Mean Annual Flow	433	1.9	1.5	150

Gila River Boating

- Historical Accounts
- Modern Recreational Boating
 - Gila Box
 - Winkleman
 - Salt River Confluence to Gillespie Dam

