

# **Gila River Navigability**

**Presentation to ANSAC**

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## Definition of Navigability

- A.R.S. § 37-1101(5)

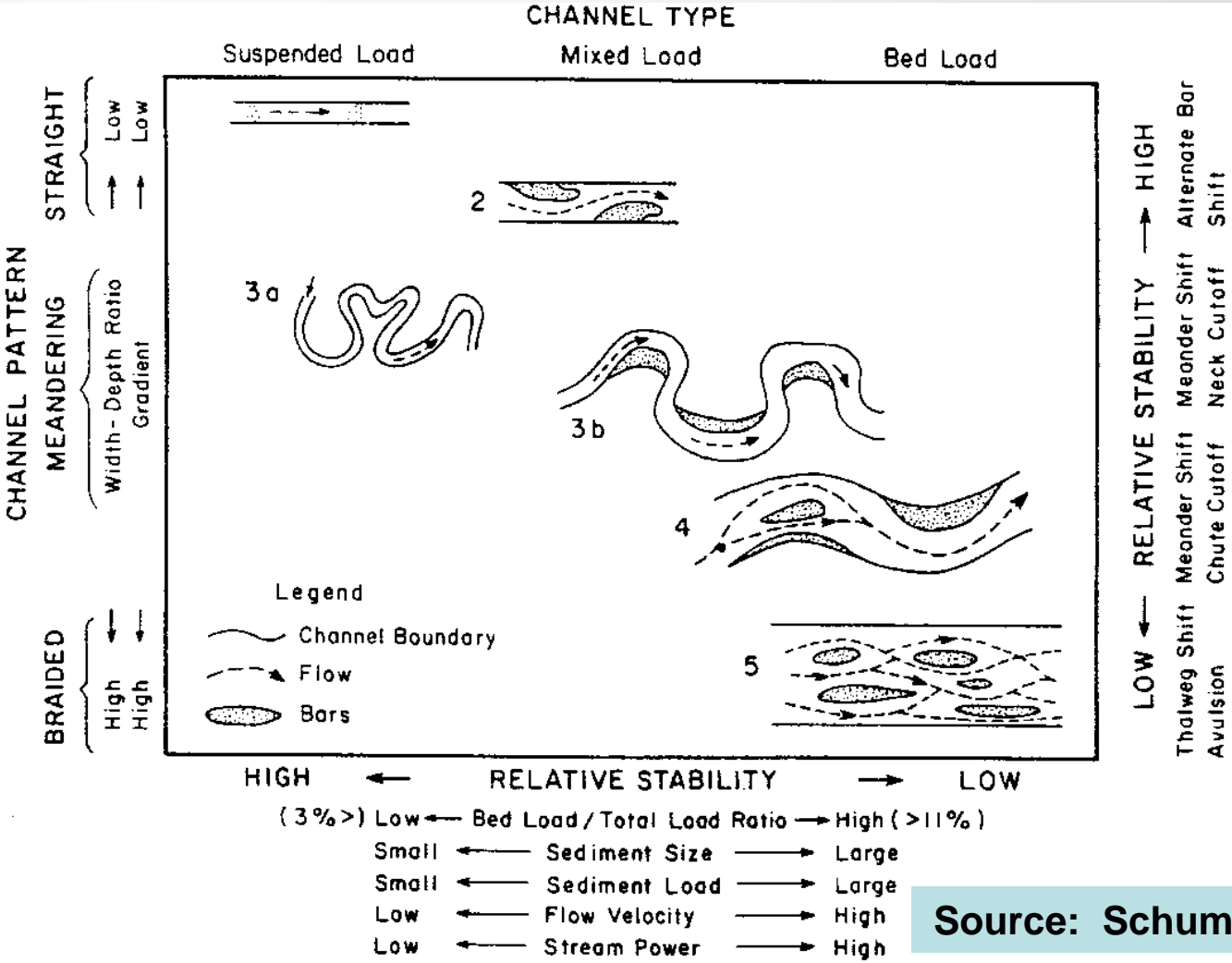
“Navigable” or “navigable watercourse” means a watercourse that was in existence on February 14, 1912, and at that time was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in customary modes of trade and travel on water.

# Definition of Navigability

## ■ PPL Montana

- *...evidence [of present-day, primarily recreational use] 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.*

# Channel Classification Relevant to Gila River Navigability



Source: Schumm (1981)

# Examples of Channel Types

Single-thread “Navigable” Channel  
U.S. v Utah

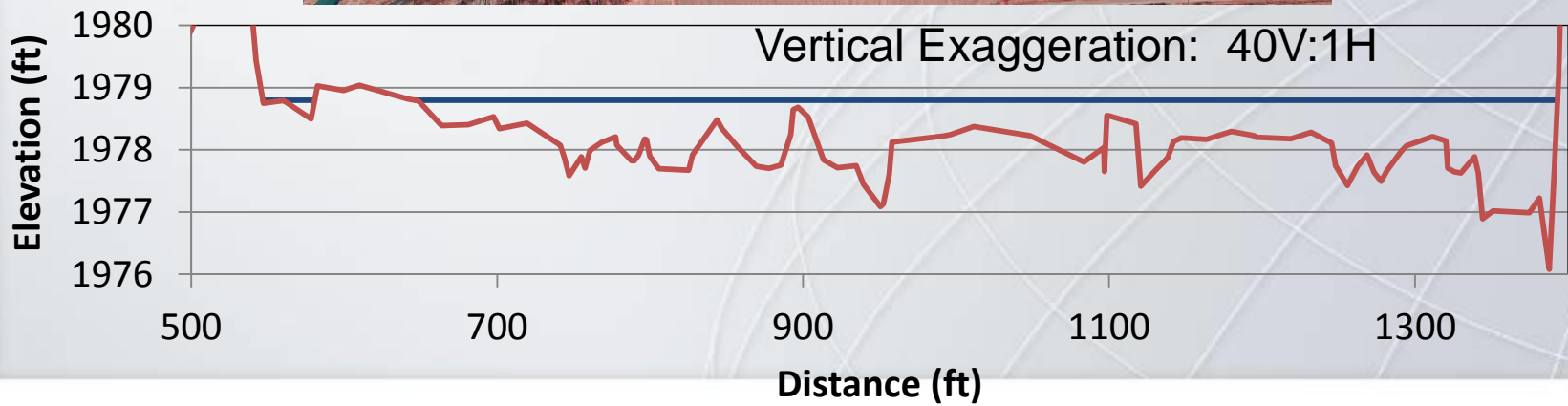
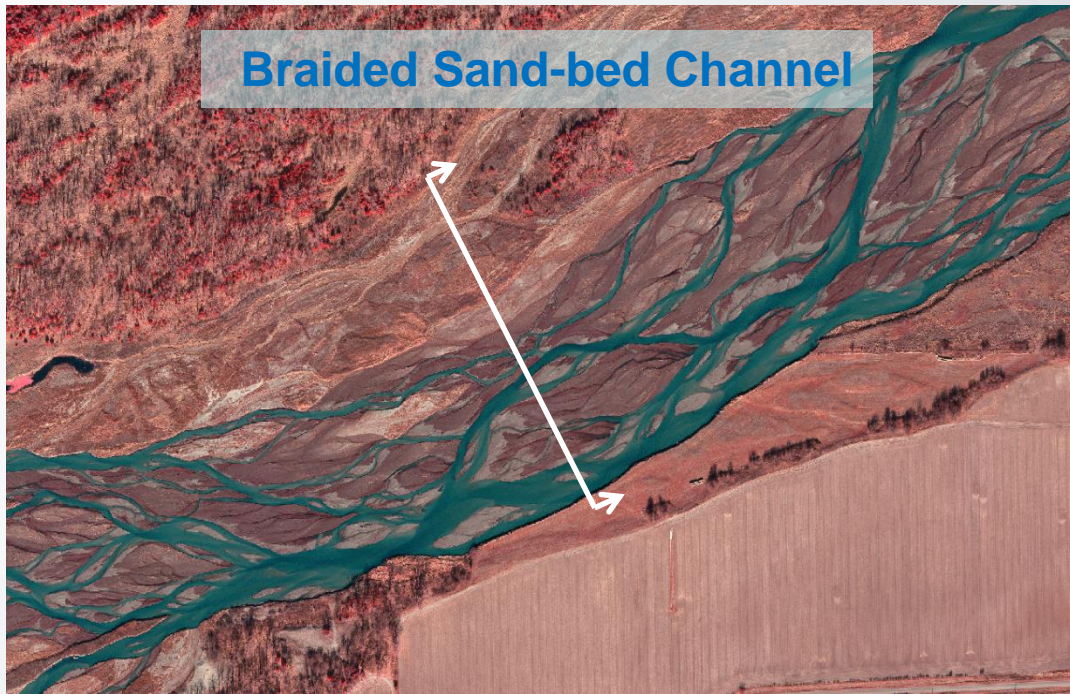


# Examples of Channel Types

Single-thread Meandering Channel



# Examples of Channel Types



# Examples of Channel Types

**Braided Cobble-bed Channel**





# Examples of Channel Types

**Braided Cobble-bed Channel**



# Channel Pattern IS Relevant to Navigability

- Braided channels:
  - Wide, shallow cross section
  - Multiple, unstable (i.e., shifting) channels
  - NOT conducive to boating



# Channel Pattern IS Relevant to Navigability

- United States v Utah (283 U.S. 85)

The principal impediment to navigation is (*sic*) found is shifting sandbars....

# Gila River Dynamics

## ■ Mid-1800s:

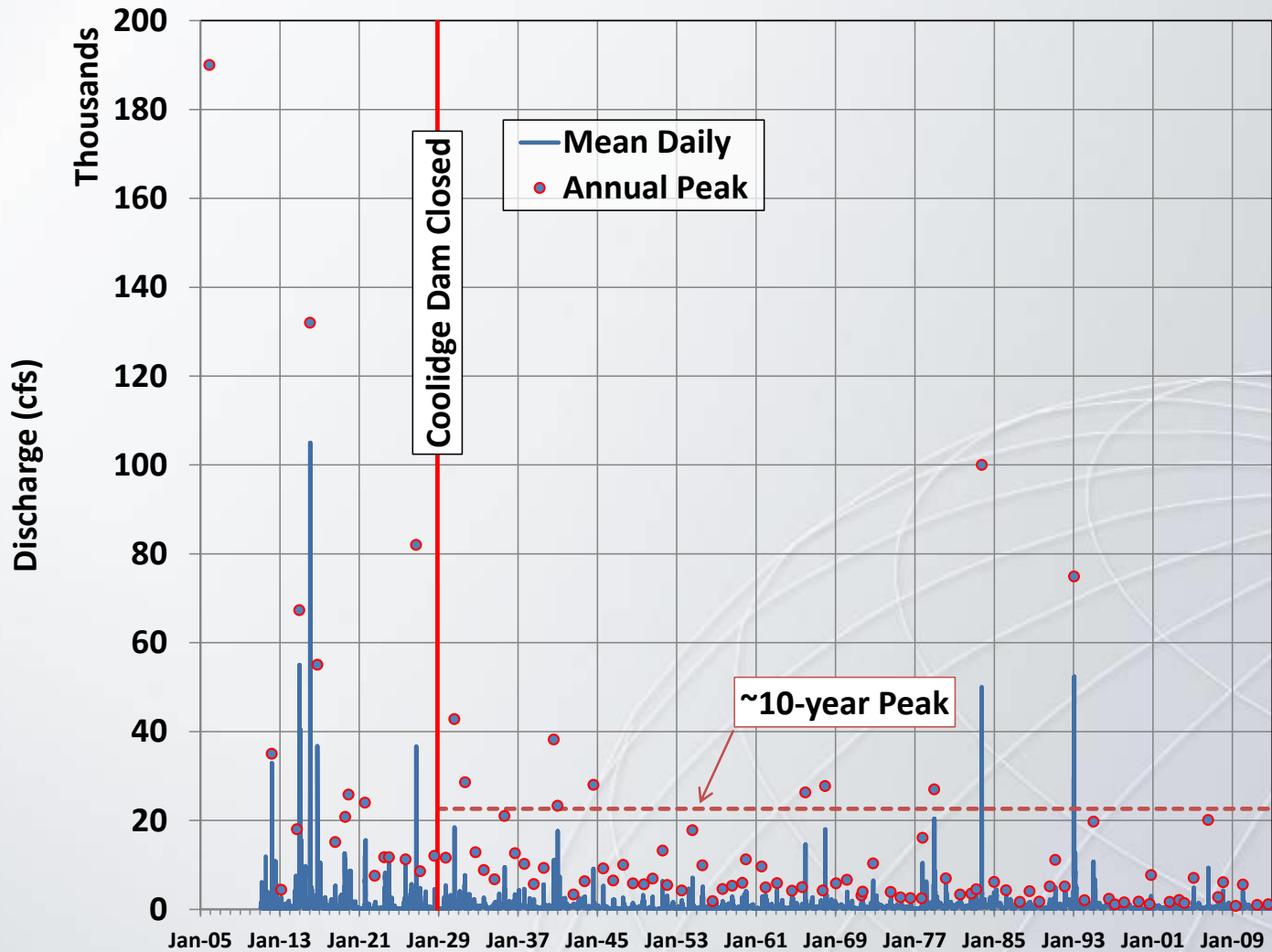
- Gila River may have been single-thread channel during periods of extended low flow; however...

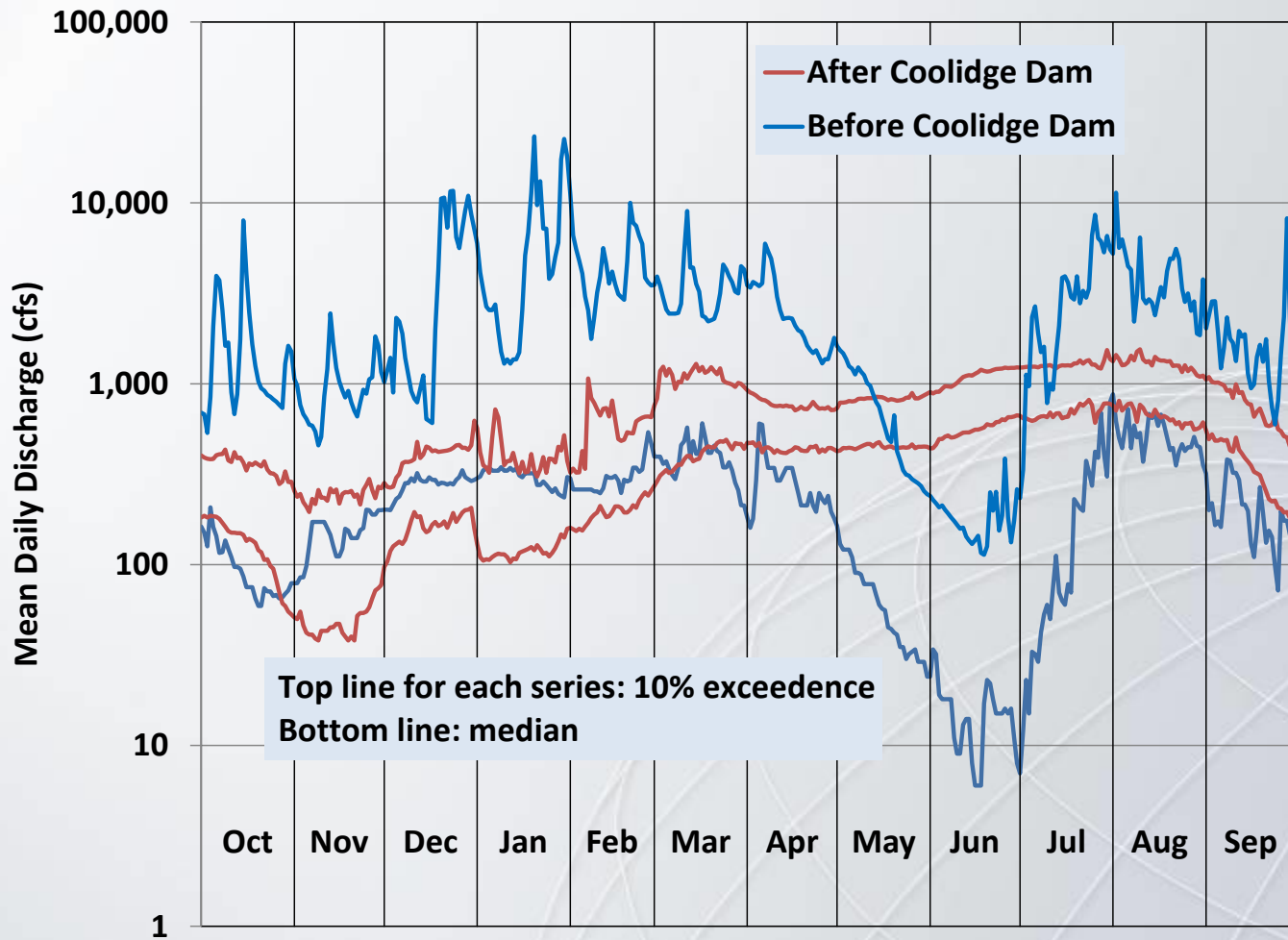
## ■ Strongly flood driven:

*Periods of increased flood frequency are more likely to be associated with wide, braided channel conditions on the Gila River (Burkham, 1972; Huckleberry, 1993b). Huckleberry (1996), p 4*

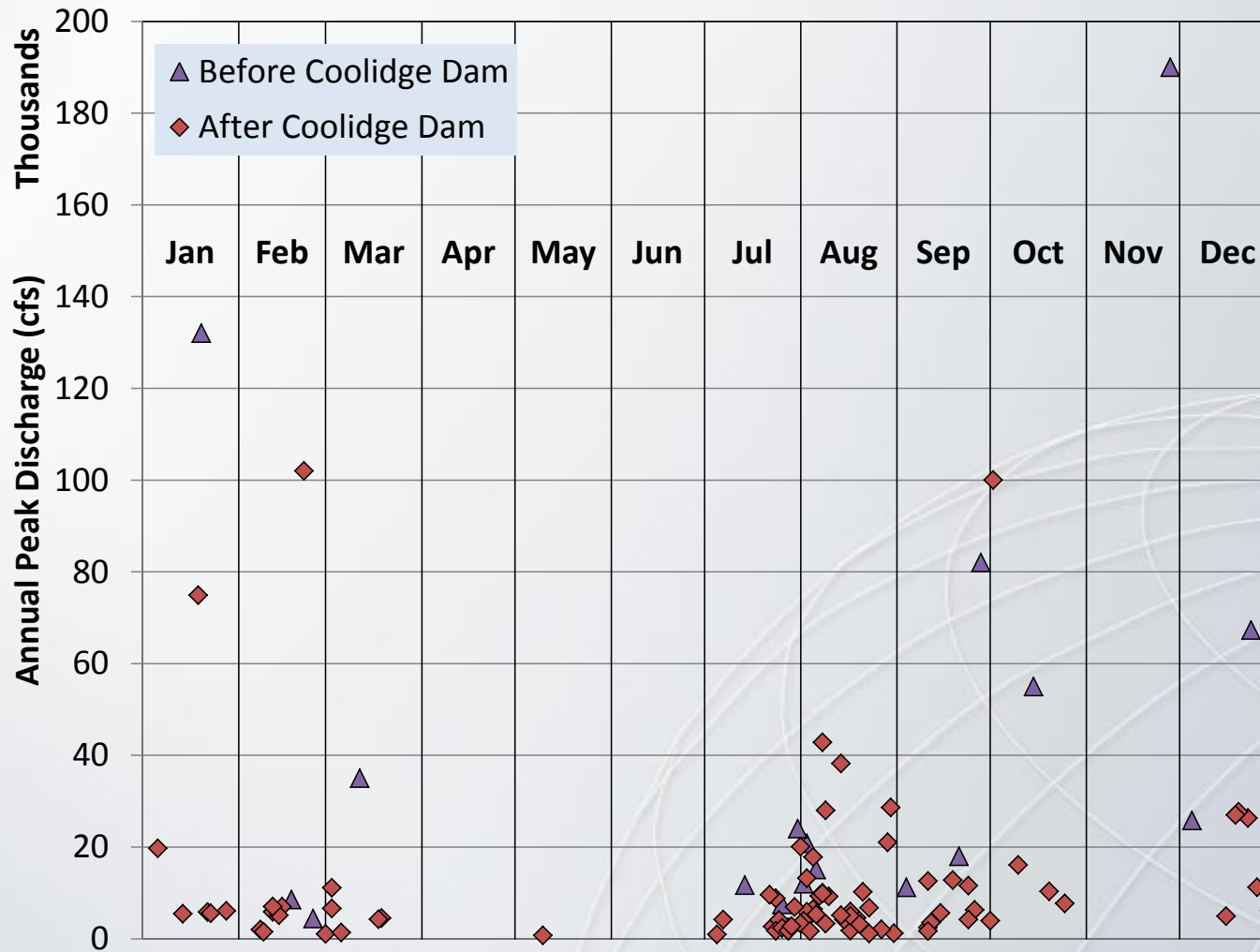
*The channel changed its geometry when the sustained flow of the floods of January, 1993 converted the compound channel above Pima Butte into a single, wide, braided channel. Huckleberry (1996), p 8*

# Gila River at Kelvin Flows

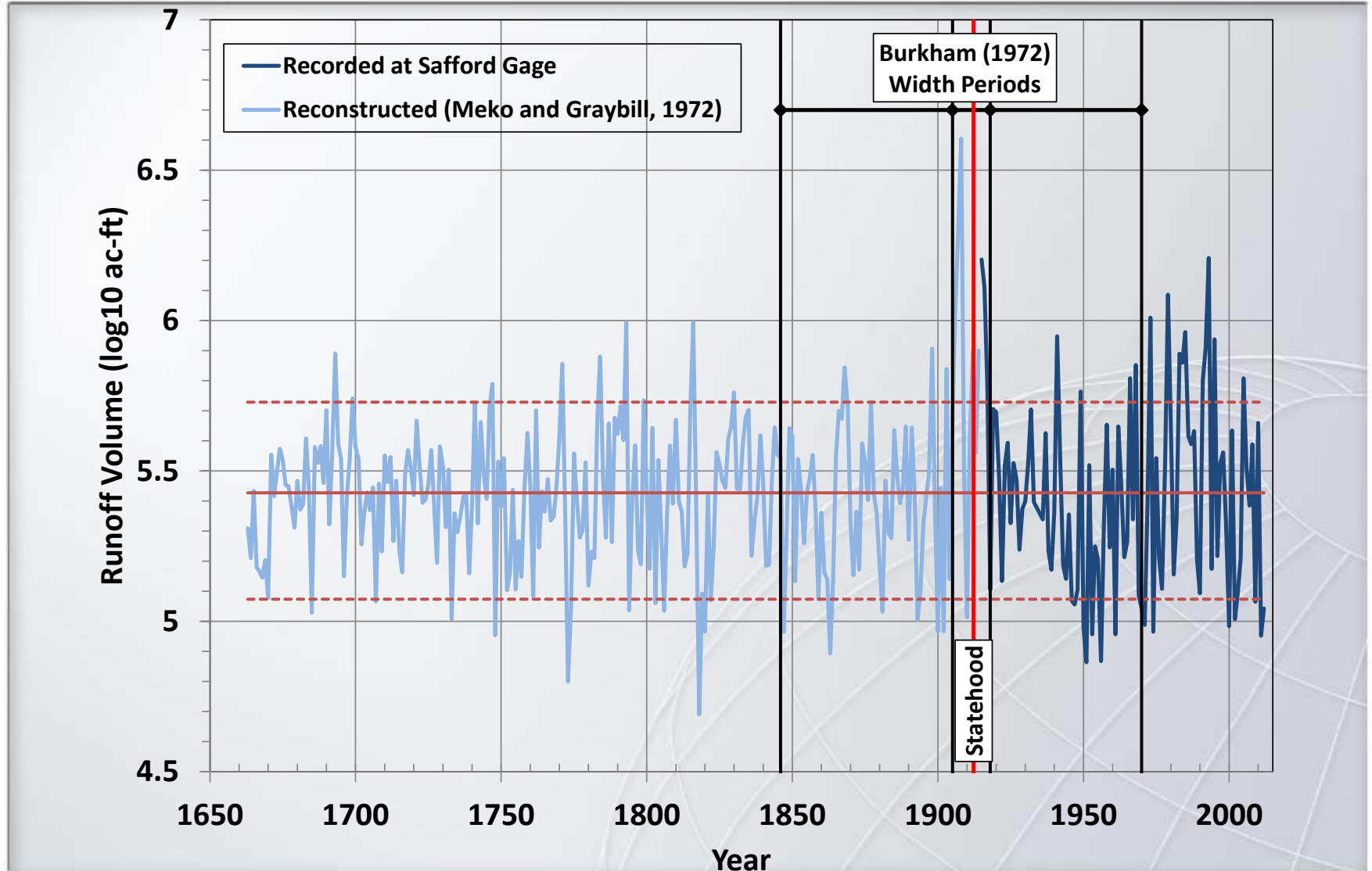




# Annual Flood Peaks: Snowmelt and Monsoon

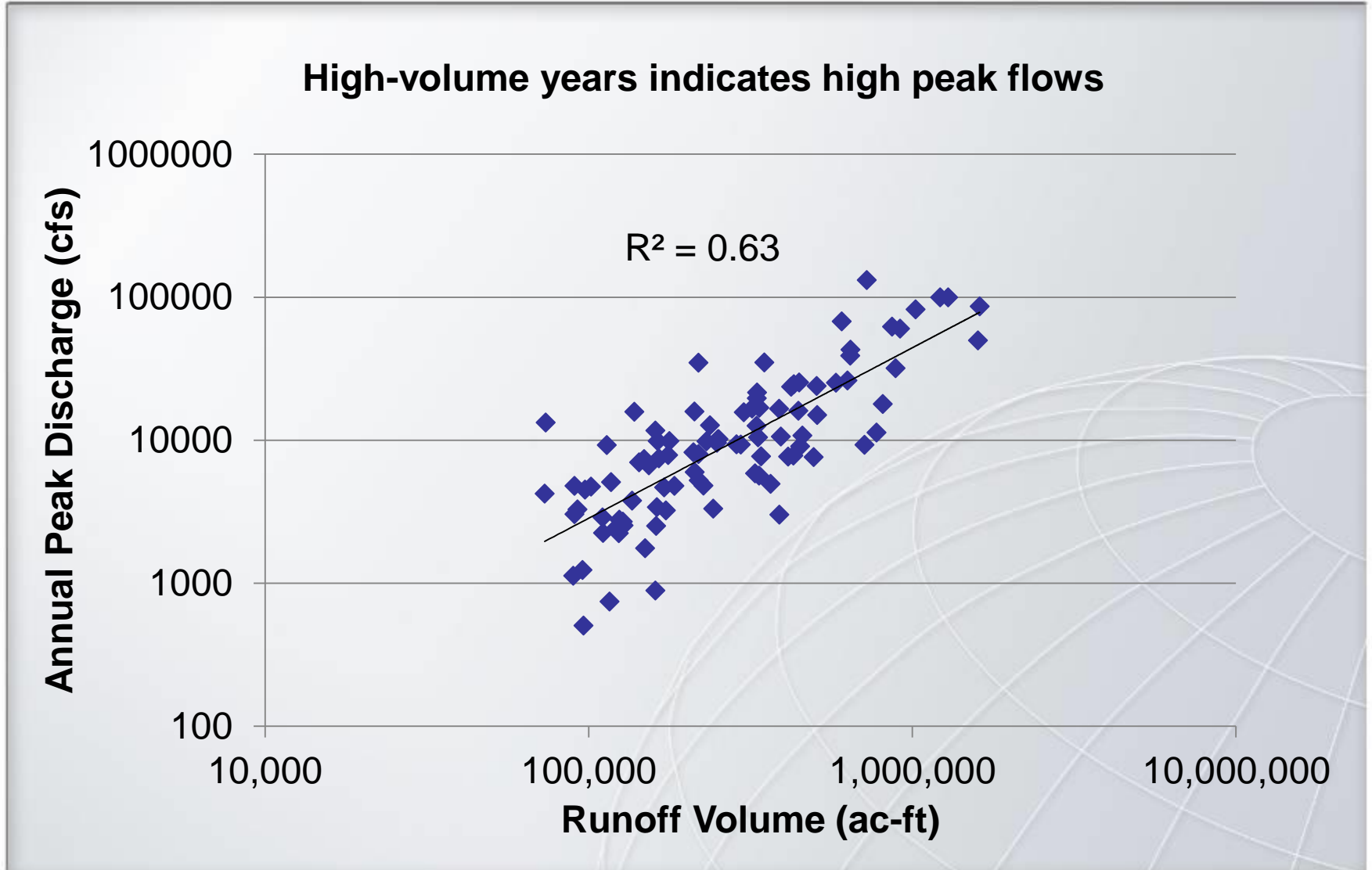


# Similar Variability in Annual Volume Pre- and Post-statehood





# Annual peak is correlated with annual volume

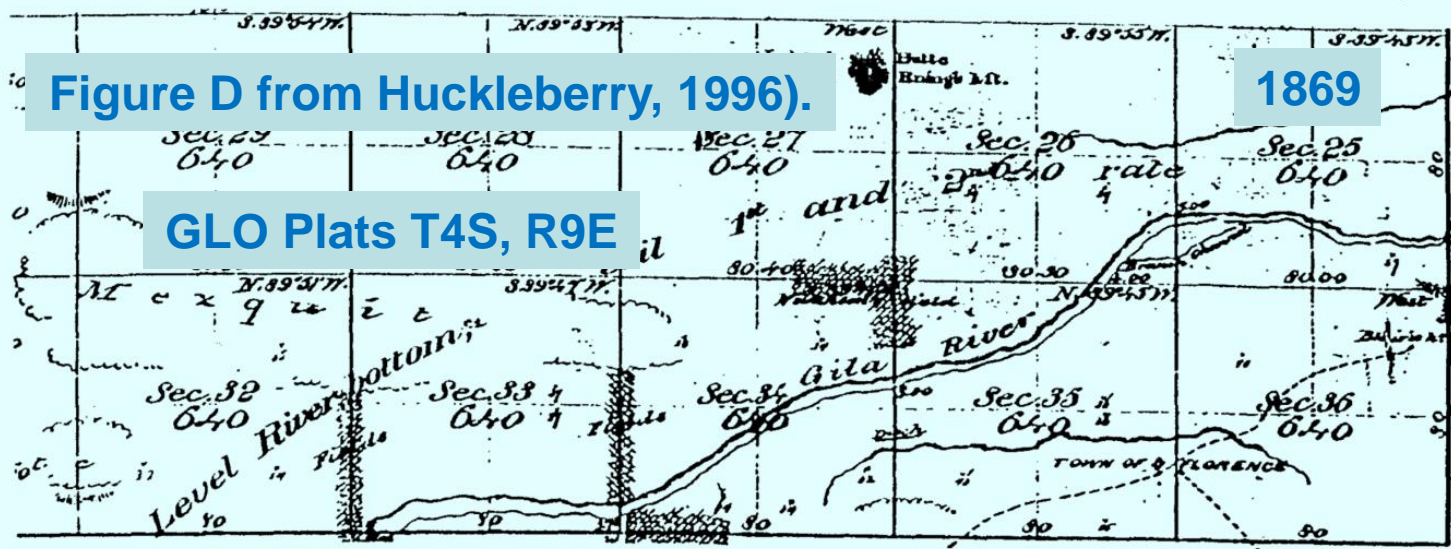


# Flood-induced Changes in Channel Width

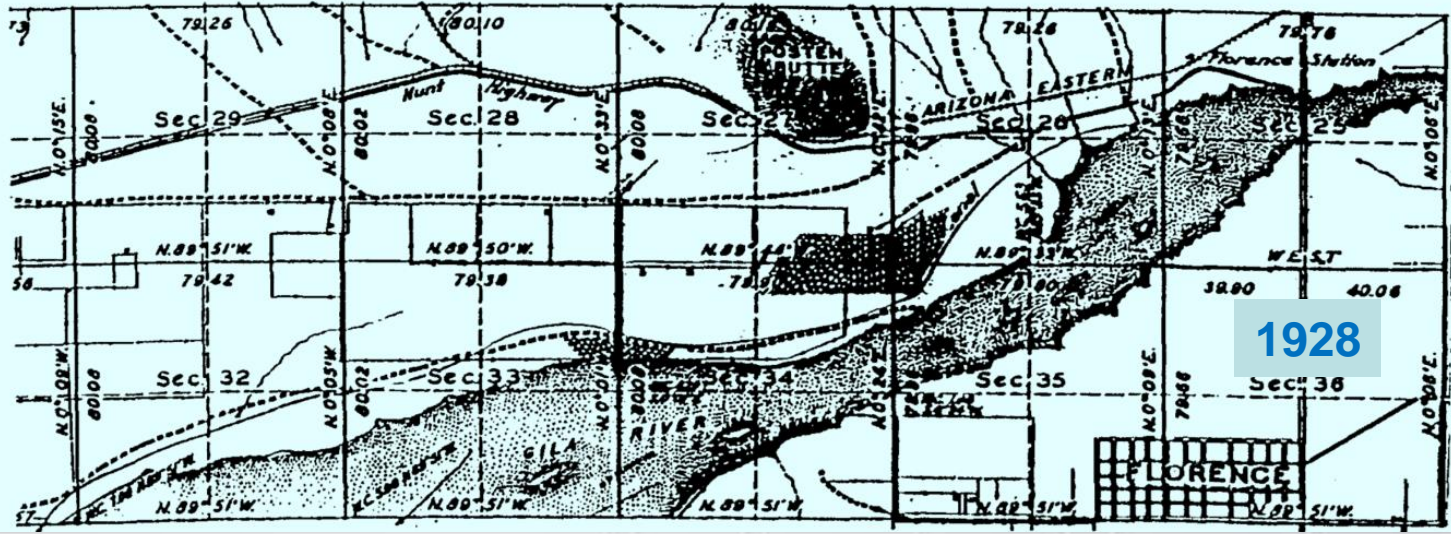
Figure D from Huckleberry, 1996).

1869

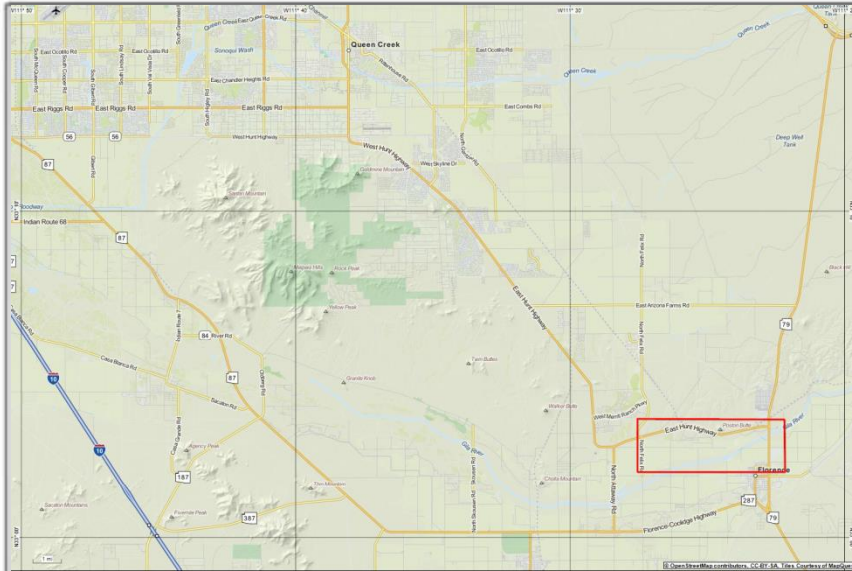
GLO Plats T4S, R9E



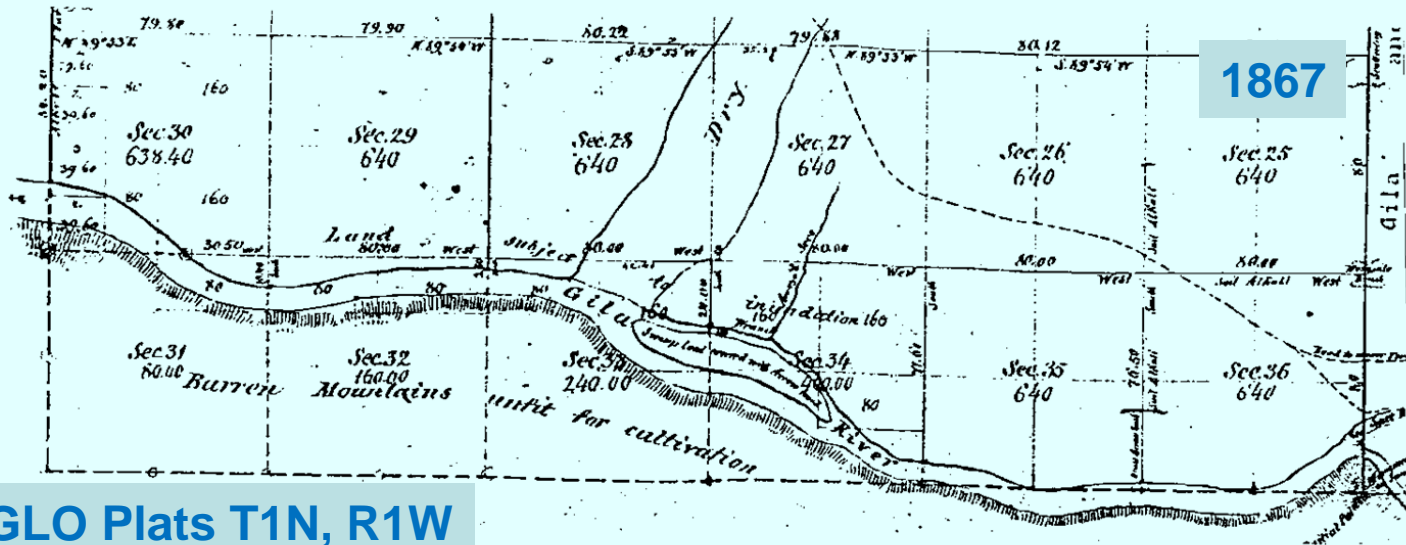
1928



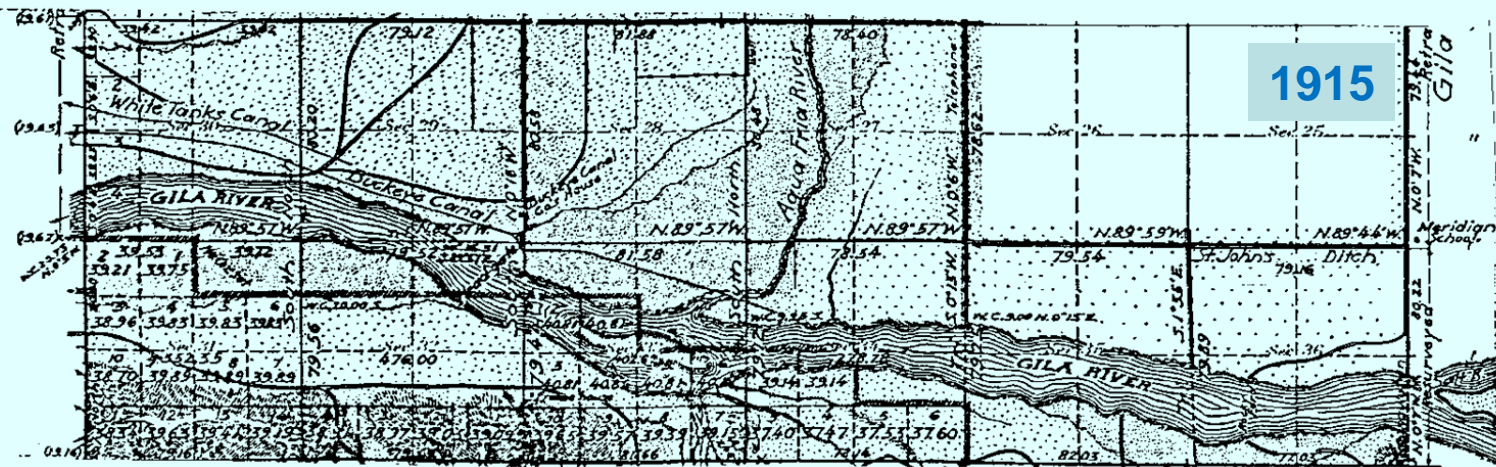
# Location of GLO Plat (April 24, 2013)



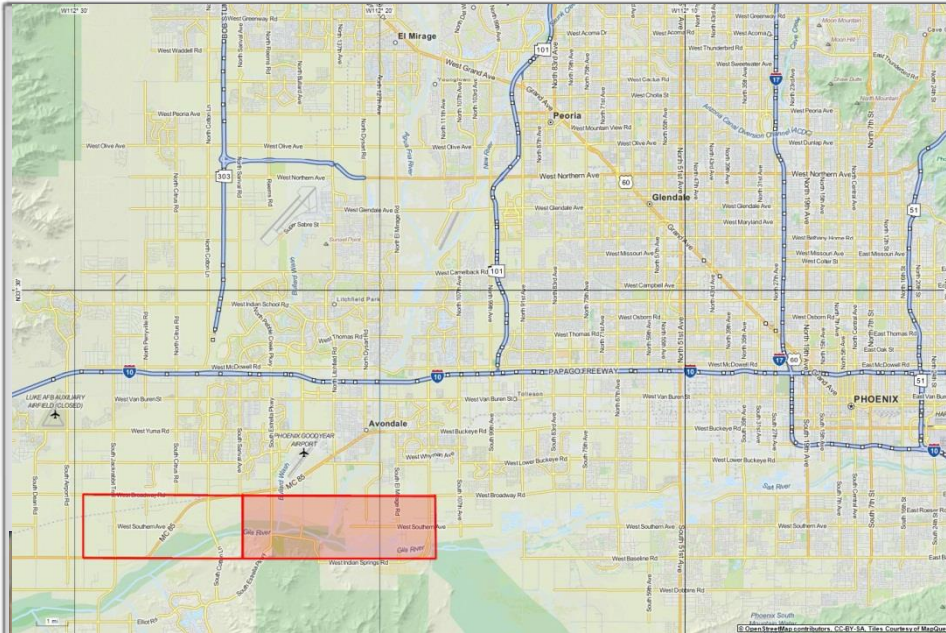
# Flood-induced Changes in Channel Width



GLO Plats T1N, R1W



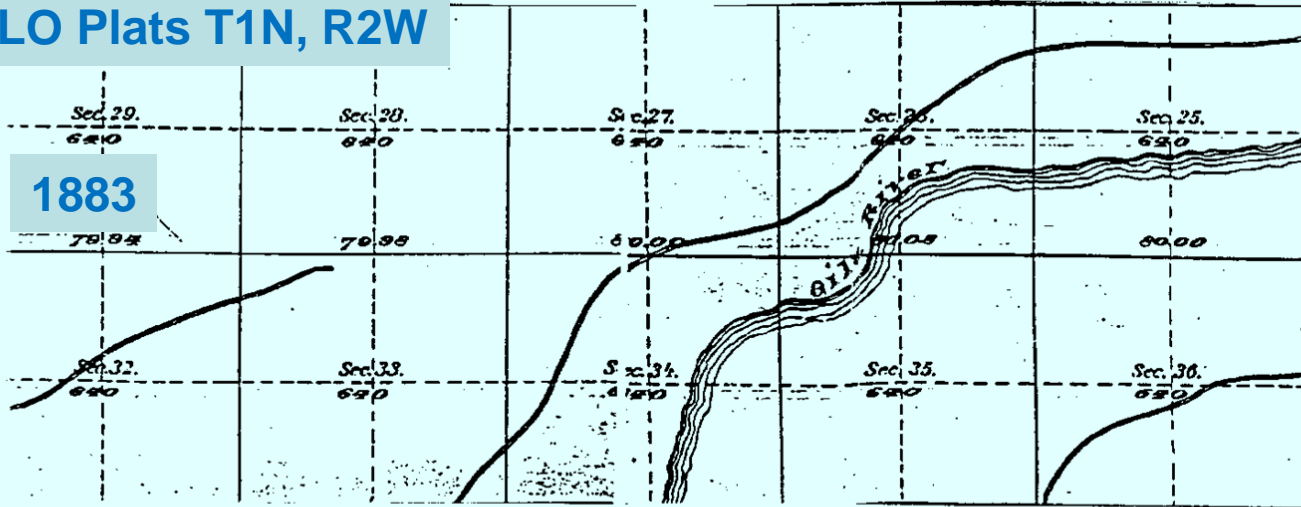
# Location of GLO Plat (March 7, 2014)



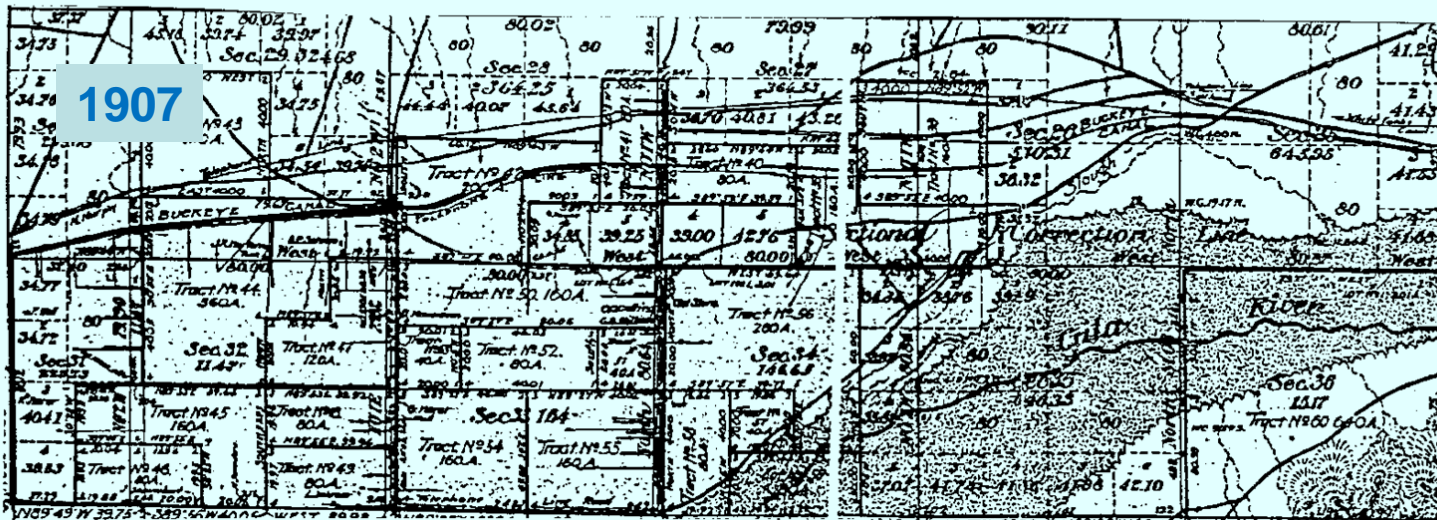
# Flood-induced Changes in Channel Width

GLO Plats T1N, R2W

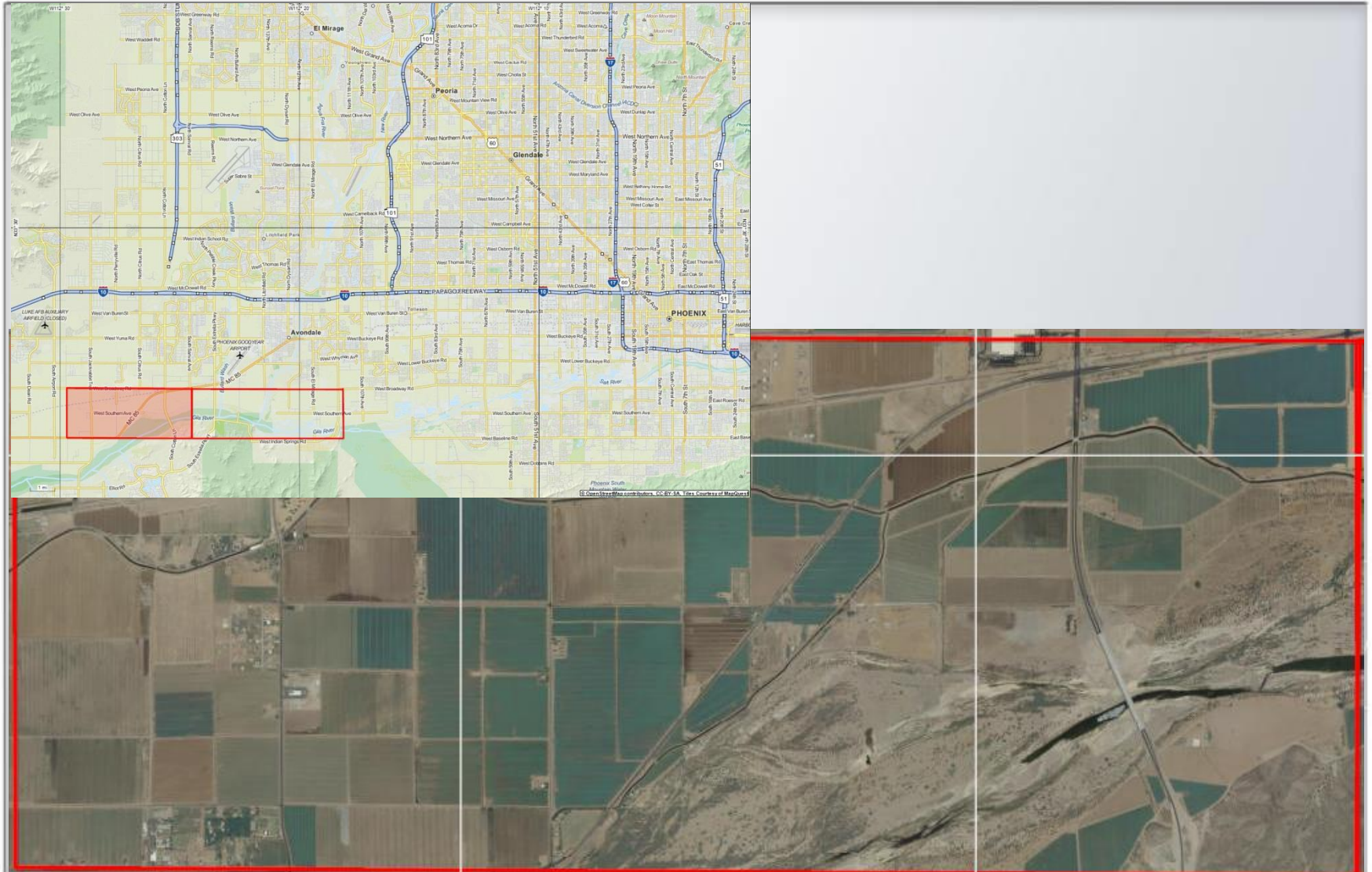
1883



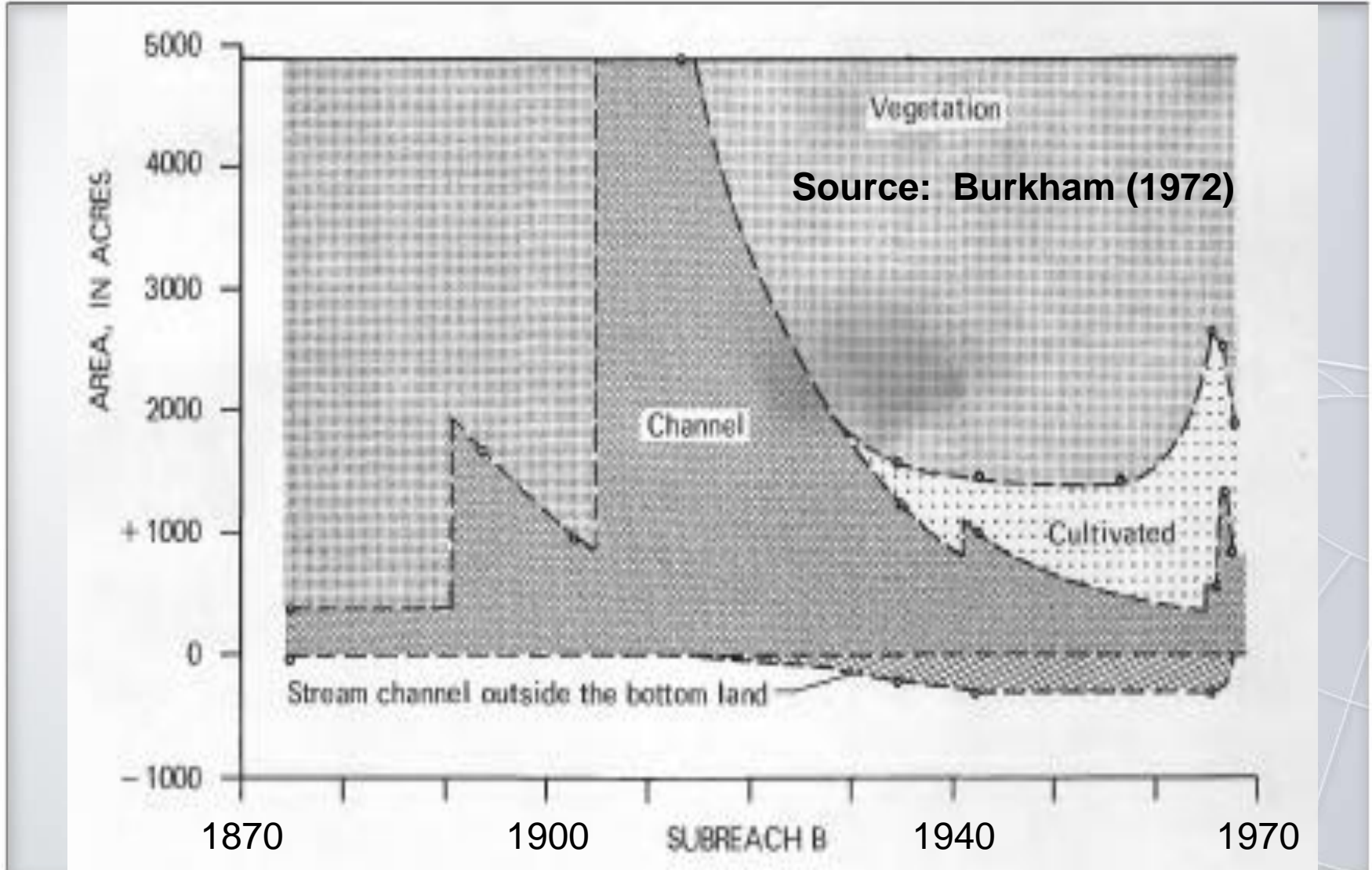
1907



# Location of GLO Plat (March 7, 2014)

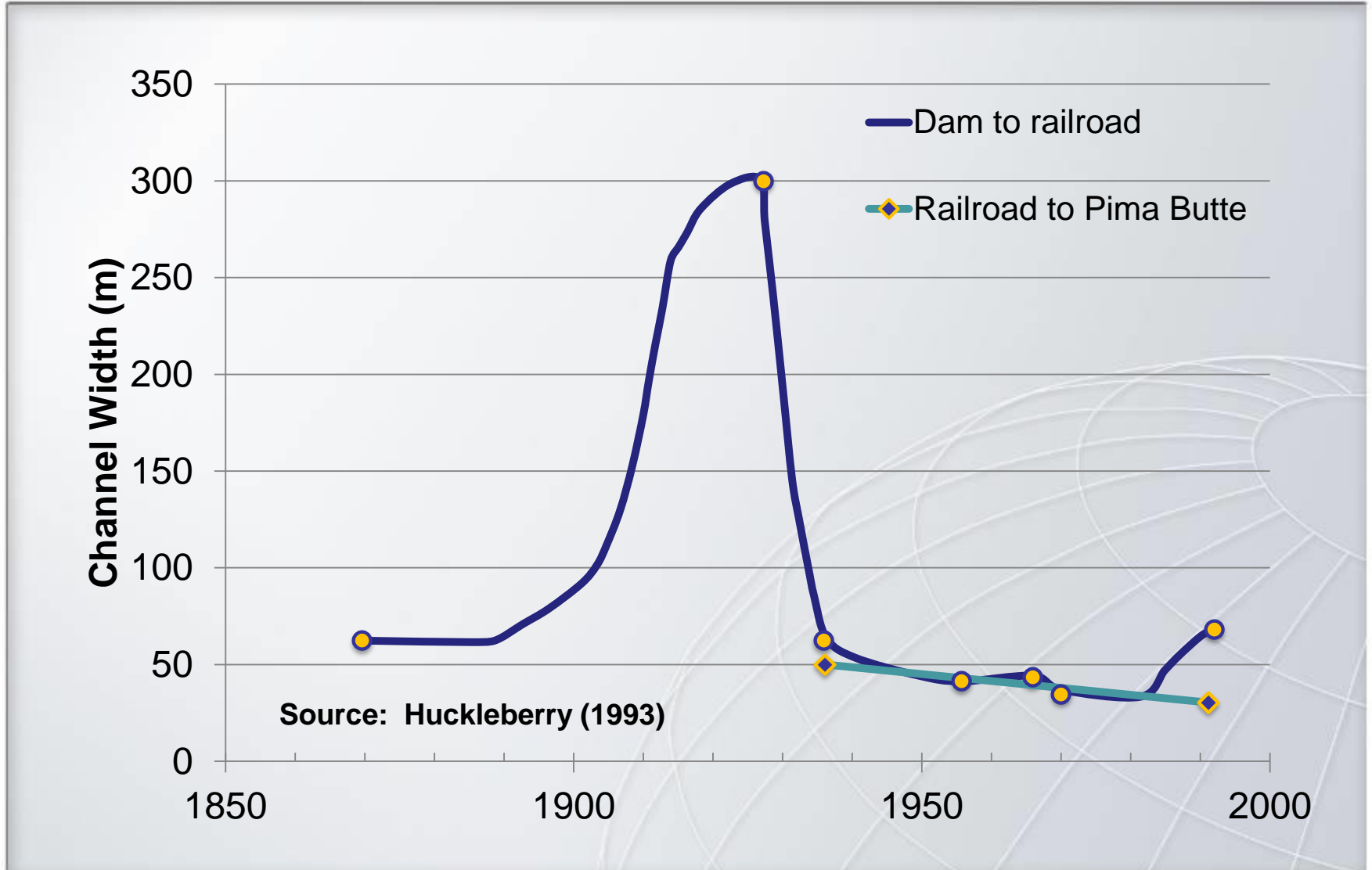


# Historical Changes in Gila River (San Simon to Pima)





# Channel Width Change, Middle Gila River



# Summary of Opinions

## ■ Mid-1800s:

- Portions of Gila River had single-thread channel lined with thick stands of woody riparian vegetation.
- It may have been possible to float a small boat in some reaches under some flow conditions

## ■ 1895 to 1916:

- Large floods scoured vegetation, eroded the banks, widened the channel,
- Gila River developed wide braided planform.

# Summary of Opinions

- Early-1900s, including date of statehood:
  - Extensive reaches were dry; carried little or no flow except during flooding.
  - Braided planform and low to non-existent flows would have made commercial navigation impractical.
  - During flood periods, navigation also impractical due to hazardous conditions, debris, uncertain and unstable channels.
- Prior to mid-1800s:
  - Reconstructed flow records show mid-1800s unusually dry
  - Large floods routinely occurred in the ordinary and natural condition of the Gila River

## Summary of Opinions

**The Gila River was NOT used nor susceptible to being used, in its ordinary and natural condition, as a highway for commerce, using customary modes of trade and travel on water at the time of Arizona's statehood.**