

The Bajada Canals of the Safford Basin: Small Corporate Group Collaboration in Southeastern Arizona

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The **Safford Basin** is known **archaeologically** as an area cultivated extensively in **prehistoric** times. Both dry and irrigation farming, principally by means of the elaborate canal systems on the floodplain and lower terraces of the **Gila River**, are well documented. Not appreciated, due principally to their recent discovery, are the canal systems south of the river that took flows out of washes heading in the **Pinaleño Mountains** to fields on the tops of **Pleistocene** terraces.

Presently, 28 canal systems and segments of systems have been identified, some beginning in the **bajada** while others branch from drainages originating in the bajada. Because some of these features appear down stream from another, it is likely that they were once joined as a single system. The two longest systems (Frye Mesa/Robinson canal and the Ash Creek/Mud Springs canal) are about 9.5 kilometers (ca. 6 miles) in length and course northeastward to relic fields atop the terrace just above and south of the Gila River floodplain. The total length of all of these canals is estimated at about 80 kilometers (ca. 50 miles). Systems were identified by a combination of pedestrian field survey and using the satellite function of **Acme Mapper 2.0**. Additional field verification and **hand-held GPS** units recorded canal channel coordinates that were transferred to Acme Mapper 2.0 to generating initial location maps.

These canals have been difficult to date since our study has been based solely on surface survey. We have depended on surface artifact finds and any associated prehistoric sites to provide temporal parameters. While a few of these canals may date as early as ca. A.D. 800, the vast majority appear to have originated after ca. A.D. 1250 and persisted until ca. 1450. As common to many of the Gila River bottomland canals of the area, many of these prehistoric canals were historically refurbished to serve the inhabitants of the greater Safford area, but retain enough integrity to be recognized as having a prehistoric origin. Unfortunately, both the historic and modern constructions and land modifications have negatively affected these systems.

These canal systems are unique from those found in the vicinity of **Phoenix** and elsewhere in the Southwest in that **they obtained their water from mountain drainages** fed by runoff, springs, and **artesian** sources, rather than from rivers. They are also unusual in that they traverse the vertically undulating to severely erratic uplands of **basin and range** topography rather than being restricted to a nearly level riverine floodplain. Some carry their water load from over 1650 m (ca. 5400 ft.) down to just above the floodplain of the Gila River at about 900 m (ca. 2950 ft.).

In places the canals are of the traditional type – narrow, linear excavations into the ground surface that follow the contours of the landscape. In other locations within the same system, **they appear as “perched” or “hanging canals** that traverse sheer sides of **mesas** — with some about 60 meters above the basin floor. The canals often create the illusion of **water flowing uphill** in that the mesa top slope is usually somewhat steeper than the rate of fall of the canal itself. In the latter cases, **the hanging segments can end up essentially independent of the surrounding terrain**, thus reducing energy input resulting from the need to excavate additional canal segments to cut and fill to follow the irregularities of the topography.

After reaching a mesa top through a long, gentle, and an apparently carefully calculated optimal grade, and then continuing as directly as possible along the characteristically flat but gently sloped ground surface, the canals will typically “fall off” the far end of the mesa in steep but apparently highly controlled and nondestructive cascades descending in near vertical **French Drain**-like constructs.

Canal cross-sections vary from 0.30 to one meter, with **atypical examples** up to two meters in width, and 20 to 40 centimeters in depth. Their use seems to be primarily long distance water delivery to fields, but the canals also apparently supplied water to small habitation sites and complexes. When assisted by historic rebuilds, several reaches of the canals still flow to this day. Portions of most of the systems remain largely pristine, and many are currently filled with fine-grained sediments. These systems are located mostly on **Arizona State** and on **Coronado National Forest** lands that remain largely undeveloped. While often of difficult access, major canal portions are usually easily traced. There are few access roads and fewer mesa top trails.

A number of unusual constructions were incorporated into some of these canal systems; two examples are: an **aqueduct**, about one and a half meters in height and 100 meters long, was constructed to bridge a saddle in the topography associated with prehistoric segment of the Lebanon Canal. At a point where the primary Frye Mesa Canal is situated near the top edge of the mesa, **a branching “counterflow” canal** was excavated down the mesa slope at an acute angle apparently to irrigate fields lying below and behind the point of branching.

Several canal systems illustrate elaborate methods of purposeful switching of the water routes between major delivery drainages. In sum, these systems appear to

represent a major understanding and a very careful exploitation of both hydraulic fundamentals as well as extreme energy and use efficiency.

Engineering can be defined as a sense of the fitness of things. Aptly meeting all these criteria, the Safford Basin bajada canal systems represent a sophisticated innovation that is superbly energy optimal and a brilliant engineering solution for reliable water transport and delivery over the basin and range topography of the area. They are a phenomenal adaptation to an arid environment to irrigate their agricultural fields distant from a once apparently abundant water source.

The discovery of these canals and recent survey in the Safford Basin suggest that the basin was a prehistoric population center and a major supplier of cultivated crops. Surveys in Lefthand Canyon (near the west boundary) and in Marijilda Canyon (near the east boundary) recorded a rather heavy population that was concentrated along the canals, but the sites are nearly all small and scattered.

Survey along many of the other canals recorded only a few smaller sites. These findings provide evidence in the form of agricultural intensification and settlement that points to a socio-political organization based on the collaboration and the collective action of small corporate groups rather than a more complex social stratification and socio-political structure.

These findings parallel those reported by **Hunt et. al (2005)** in their **American Antiquity** article on the **Hohokam** area. As a Hohokam presence has been noted for the Safford basin, we might suggest that Hohokam migrants may have at least in part engineered the sophisticated canal constructions.

Suggested Reading:

Lancaster, Don

2013 Prehistoric Hanging Canals of the Safford Basin (Update III).

Published in **Wesrch** and at <http://www.tinaja.com/tinsamp1.shtml>.

Lancaster, Don

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2013 Prehistoric Agricultural Strategies in the Safford Basin, Southeastern Arizona. In *Between Mimbres and Hohokam: Exploring the Archaeology and History of Southeastern Arizona and Southwestern New Mexico*, edited by H.D. Wallace. Anthropological Papers No. 51, Archaeology Southwest. Tucson.

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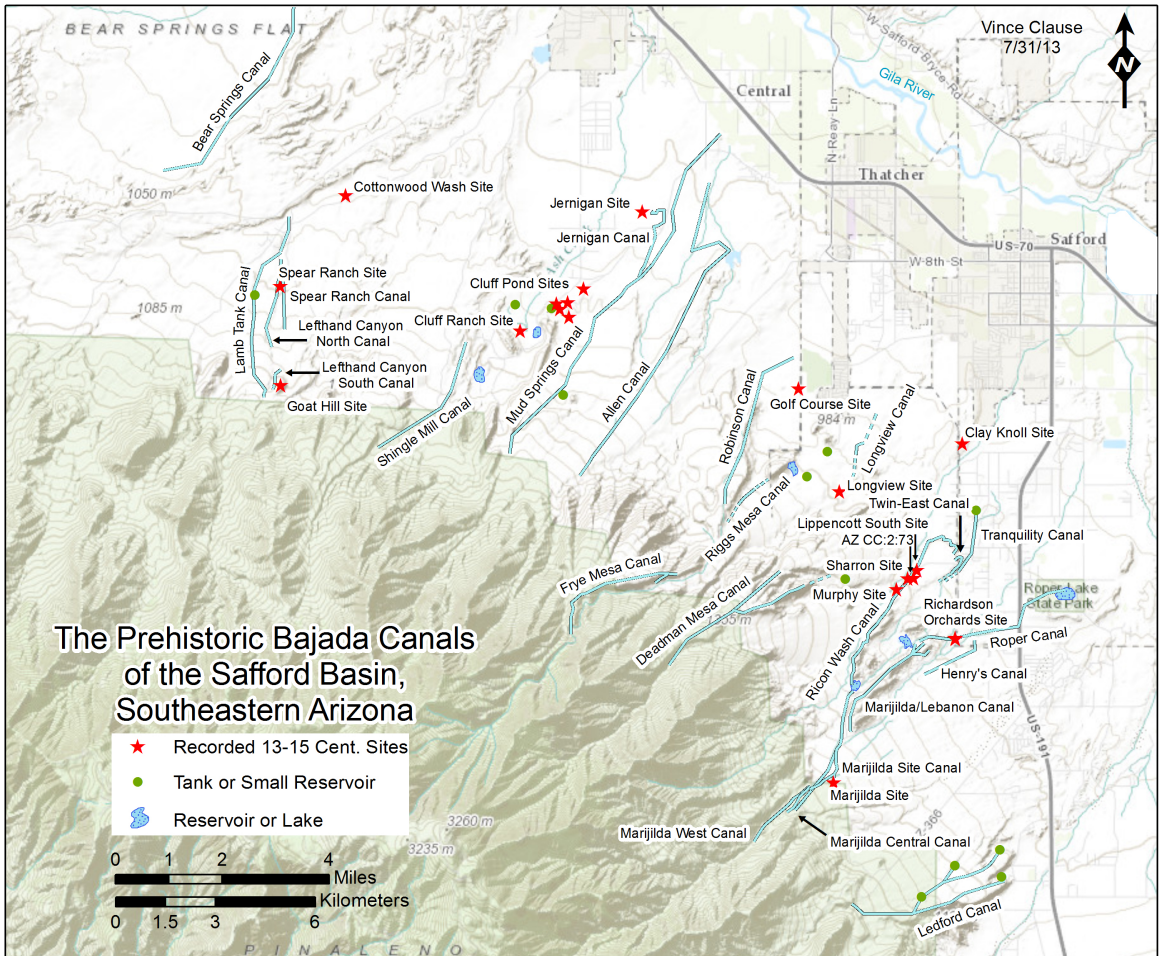
2005 Prehistoric Agricultural and Settlement Systems in Lefthand Canyon, Safford Valley, Southeastern Arizona. In *Inscriptions: Papers in Honor of Richard and Nathalie Woodbury*, edited by R. N. Wiseman, T. O Laughlin, and C. T. Snow, pp. 145-169. Papers of the Archaeological Society of New Mexico 31. Albuquerque.

Neely, James A. and Murphey, Everett J.

2008 Prehistoric Gila River Canals of the Safford Basin, Southeastern Arizona: An Initial Consideration. In *Crossroads of the Southwest: Culture, Identity, and Migration in Arizona's Safford Basin* (Proceedings of the AAC Fall 2005 Meeting), edited by David E. Purcell, pp. 61-101. Cambridge Scholars Publishing. Newcastle, UK.

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Hunt, R.C., D. Gullett, D. Abbot, J. Bayman, P. Fish, S. Fish, K. Kintigh, J. Neely
2005 Plausible Ethnographic Analogies for the Social Organization of Hohokam Canal Irrigation, *American Antiquity* 70 (3): 433-456.



Map of Pinolino Mountain stream fed hanging canals under present study.



One of the more spectacular hanging canal reaches.



Hanging canal cross sections often show a "water flows uphill" illusion.