City of Phoenix
OFFICE OF THE CITY ATTORNEY

PETER VAN HAREN
City Attorney

April 3, 2003

HAND DELIVERED

Mr. George Mehnert, Executive Director
Arizona Navigable Stream Adjudication Commission
1700 West Washington, Room 304
Phoenix, Arizona 85007

Re: Hearing on the Lower Salt River Between Granite Reef Dam and the Confluence with the Gila River

Dear Mr. Mehnert:

Enclosed are seven copies of a report prepared by Dr. Doug Kupel and Ellen Endebrock, P.E. entitled "Historical and Scientific Evidence Concerning Navigability of the Lower Salt River." The City of Phoenix requests that this report be admitted into evidence pursuant to A.R.S. §37-1123 and the Commission's Draft Rule R12-17-106.01 for consideration by the Commission at its hearing on April 7, 2003 regarding the Lower Salt River Between Granite Reef Dam and the Confluence With the Gila River. The enclosed report is offered in substitution only for that document entitled "Historical and Hydrological Analysis of the Salt River With Reference to Navigability" previously filed by Phoenix with the Commission and dated December 6, 1996 but not for Exhibits 1-205 (Volumes I-III) also filed with the 1996 Analysis. Exhibits 1-205 are referenced and incorporated into the report being filed today.

The City of Phoenix does not intend to present any witnesses at the hearing commencing on April 7, 2003.

Thank you for your attention to this matter.

Respectfully,

M. James Callahan

M. JAMES CALLAHAN
Assistant City Attorney

MJC:cf/#145915
Enclosures

Historical and Scientific Evidence Concerning Navigability of the Lower Salt River

April 2003

City of Phoenix

OFFICE OF THE CITY ATTORNEY

Douglas E. Kupel, Ph.D.

Historian

Ellen G. Endebrock, P.E.

Hydrologist

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Exhibits

VOLUME I	Exhibits 1–84	(filed January 14, 1994)
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VOLUME III	Exhibits 175–205	(filed December 6, 1996)
VOLUME IV	Exhibits 206–215	(filed with this report)

Introduction and Summary

This report examines the relevant historical and scientific evidence for the navigability or non-navigability of the Lower Salt River from Granite Reef Dam to the confluence of the Gila River. The report concludes that the Salt River was not navigable at the time of statehood as of February 14, 1912. Extensive research to date has uncovered a preponderance of evidence that clearly establishes the Salt River as non-navigable on February 14, 1912.

The Lower Salt River was examined with regard to the criteria established under Title 37, Chapter 7, Arizona Revised Statutes. These criteria are to be used by the Arizona Navigable Stream Adjudication Commission (ANSAC) to receive, compile, review, and consider relevant evidence regarding the navigability of Arizona's rivers and streams for title purposes.

This report was prepared by historian Douglas E. Kupel, Ph.D., and civil engineer Ellen Endebrock. Both authors are employees of the City of Phoenix.

Doug Kupel has nearly twenty-five years of experience as a public historian and has been specializing in water history since he moved to Arizona in 1983. He holds a Bachelor of Arts degree in history from the University of Oregon, a Master of Arts degree in history from the University of Arizona, and a Ph.D. in history from Arizona State University. In addition to his coursework in history, Dr. Kupel has earned a certificate degree in archaeology from the University of South Carolina. He is registered as a professional archaeologist by the Register of Professional Archaeologists. Dr. Kupel's most recent publication is a book titled *Fuel for Growth: Water and Arizona's Urban Environment*, published by the University of Arizona Press in 2003. Dr. Kupel's resume is appended to this report as Exhibit No. 206.

Ellen Endebrock has over eleven years of experience in hydrology and water resources engineering. She holds a Bachelor of Science degree in geology from Northern Arizona University and a Master of Science degree in civil engineering from New Mexico State University. She is registered as a Professional Engineer in both Arizona and California, and has practiced in both states. Ms. Endebrock has also attended continuing education workshops on the subject of stream geomorphology: natural stream channel restoration, sponsored by the Natural Resources Conservation Service; and stream channel assessment, sponsored by the U.S. Forest Service. Ms. Endebrock's resume is Exhibit No. 207.

In addition to this report, the City of Phoenix has filed three volumes of evidence and an earlier report with ANSAC. Evidence Volumes I and II were filed on January 14, 1994, in association with the City's Notice of Appearance in ANSAC Cause No. 94-1. Those previously submitted materials consisted of 174 exhibits. Volume III of the City's evidence, covering exhibits numbered 175 to 205, were filed with the City's December 6, 1996, report titled *Historical and*

Hydrological Analysis of the Salt River With Reference to Navigability, Granite Reef Dam to the Confluence with the Gila River, Arizona (hereafter "*Analysis*"), by Douglas E. Kupel and Thomas Buschatzke. Volume IV of the City's evidence, covering exhibits numbered 206 to 215, is appended to this report.

This report is filed in substitution of the 1996 Kupel and Buschatzke *Analysis*, but retains and incorporates by reference Volumes I through III of the City's evidence filed with that *Analysis*.

Presentation of Evidence

1. Prior Judicial Proceedings

There are many prior judicial determinations that the Lower Salt River was not navigable prior to and including February 14, 1912. In contrast, not a single judicial determination of navigability has been uncovered for the Lower Salt River. There is a preponderance of evidence that prior judicial determinations found the Lower Salt River not navigable.

Perhaps the best example of this for the Salt River is the U.S. District Court for the District of Arizona finding in case no. CIV-72-376 PHX in 1976 that the Salt River serving as the boundary for the Salt River Pima Maricopa Indian Community was a non-navigable river (see submittal #96-002-004-009). In addition to this recent consideration of Salt River navigability, there are several earlier judicial proceedings during which the navigability of the Salt River was specifically addressed and found to be not navigable.

The Salt River has been at the center of innumerable lawsuits, primarily concerning water rights. In every lawsuit examined that mentions the navigability of the Salt River, the Salt River has always been described as non-navigable. Since the record is voluminous in this regard, a summary of information excerpted from judicial proceedings and is listed in Table #1.

TABLE # 1	
EXCERPTED JUDICIAL PROCEEDINGS THAT REFERENCE SALT RIVER NAVIGABILITY	
EXHIBIT NO.	DESCRIPTION
6	"Salt River is an unnavigable stream" (1905)
7	"Salt River is an unnavigable stream" (1905)
8	"Salt River is an unnavigable stream" (1905)
9	"Salt River is an unnavigable stream" (1907)
10	"Salt River is an unnavigable stream" (1905)
11	"Salt River is a natural unnavigable stream" (1896)
12	"Salt River is an unnavigable stream" (1895)
13	"Salt River is a natural innavigable stream" (1894)
14	"Salt River, an unnavigable stream" (1898)
15	"Salt River an unnavigable stream" (1899)

TABLE # 1	
EXCERPTED JUDICIAL PROCEEDINGS THAT REFERENCE SALT RIVER NAVIGABILITY	
EXHIBIT NO.	DESCRIPTION
16	"Salt River, an unnavigable stream" (1898)
17	"Salt River is an unnavigable stream" (1896)
19	"Salt River is an unnavigable stream" (1894)
20	"Salt River is a natural innavigable stream" (1895)
21	"Salt River is a natural innavigable stream" (1893)
22	"Salt River, an unnavigable stream" (1893)
23	"Salt River an unnavigable stream" (1893)
24	"Salt River, a natural unnavigable stream" (1890)
25	"Salt River, a natural unnavigable stream" (1890)
26	"Salt River, an unnavigable stream" (1893)
27	"Salt River, an unnavigable stream" (1893)
28	"Salt River, an unnavigable stream" (1893)
29	"Salt River is an unnavigable stream" (1914)
30	"Salt River, an unnavigable stream" (1907)
31	"Salt River is an innavigable stream" (1909)
165	"Salt River is a natural unnavigable stream" (1892)

It is evident from the many references listed in Table #1 that the Salt River was clearly considered non-navigable in several independent judicial proceedings prior to and after statehood.

The classification of the Salt River as non-navigable was important from a water rights standpoint during the era prior to statehood. The incorporation of language documenting the non-navigable condition of the Salt River in these many public legal proceedings was necessary to demonstrate the importance of water for irrigation of the arid lands of the Salt River Valley. Without water, these lands were valueless. Had the Salt River been navigable, the water would have had importance from a navigation standpoint. While there are many disputes over water rights in the Salt River Valley, including such uses as irrigation, milling, and electrical generation, there are no recorded instances in judicial proceedings where navigation was described as a potential water use.

The integral relationship between water rights and non-navigability is demonstrated by the "Findings of Fact" written by Judge Edward Kent in the District Court for Arizona Territory case of W.W. Dobson, et al v. James Johnson and issued in January of 1910 (Cause No. 5842). This particular finding of fact merits quotation at length because it takes judicial notice of the condition of the Salt River just two years prior to statehood:

> "That the Salt River is an innavigable stream flowing in a general Northeast to Southwest direction through Maricopa County, Arizona, and that all the members of said Utah Irrigating Canal Company are the owners and occupants of lands irrigable from said river, and that all of said lands are naturally arid and unproductive without the application of water thereto by means of irrigation, and when so irrigated are fertile and productive" (Ex. No. 31).

Judge Edward Kent used similar language later in 1910, in March, when he issued his decree in the Hurley v. Abbott case. This case, a large water rights case involving thousands of claimants in the Salt River Valley, was a public proceeding which had started in 1905. Five years later, Judge Kent issued his decree. It read, in part, "[e]ntering the Valley from the northeast is the Salt River, a non-navigable stream." This finding by Judge Kent is clearly a significant part of the case, establishing as it does the importance of water in the Salt River for irrigation and not for navigation. The Kent Decree goes on to describe, in great detail, the water rights appurtenant to parcels of irrigated land in the Salt River Valley. The water use described in the Kent Decree includes all of the normal flow of the Salt River, as well as flood and surplus water used directly or subsequently stored and developed behind Roosevelt Dam that was previously lost during floods. Despite this microscopic examination of water use from the Salt River, navigation is not mentioned. The Kent Decree is filed as Ex. No. 177.

2. Territorial and County Government Proceedings

In addition to prior judicial determinations, territorial and county governments determined that the Salt River was non-navigable at the time of Arizona statehood. Perhaps the most significant of these concerned the construction of a bridge across the Salt River at Central Avenue in Phoenix. The issue of navigability was a significant one for proponents of the bridge, because if the Salt River was considered navigable construction of the bridge could have an impact on river transportation.

The long process of authorizing construction of a bridge across the Salt River at Phoenix had its origins with an act of the Territorial Legislature. The twenty-fifth Territorial Legislature considered two bridge bills in 1909. The one concerning Phoenix became known as the "general bridge bill" (Ex. No. 140). On March 18, 1909, the Territorial Legislature adopted, and the Governor signed, a bill titled "An Act Relating to the Construction of Bridges Across Non-Navigable

Streams Within the Territory of Arizona" (Ex. Nos. 141 and 162). This bill provided that county boards of supervisors could "construct and maintain a bridge across any non-navigable stream within the county represented by said Board."

Subsequent to the territorial legislation and in conformance with its terms, citizens of Maricopa County petitioned their Board of Supervisors for construction of several bridges. These included one "across the Salt River, a non-navigable stream" at the foot of Center Street (later Central Avenue) in Phoenix, a second "across the Salt River, a non-navigable stream, at Tempe," and a third "across the Agua Fria River, a non-navigable stream" (Ex. Nos. 163 and 146 - 148). The Maricopa County Board of Supervisors approved the petition in a public session held on April 20, 1909, and referred the matter to a vote of the citizens of Maricopa County to be held on June 10, 1909.

On June 10, 1909, the voters of Maricopa County approved all three measures by simple majorities, with the following margins:

	Center Street Bridge	Tempe Bridge	Agua Fria
For	837	717	426
Against	361	275	349

However, since the bridge question had to be passed by a majority vote of all ballots cast in the election, that number being 1490 votes, only the Center Street Bridge measure passed by the necessary number. The Tempe measure fell short of the needed 746 votes by a small number, and the Agua Fria vote was well short.

Subsequent to the election, the Maricopa County Board of Supervisors asked G.P. Bullard, the county attorney, to examine several issues with regard to the bridge vote, including: (1) whether a bridge could be constructed entirely within a municipality (as was the case in Tempe); and (2) whether a majority of the votes cast was needed to pass the measure or if only a simple plurality was needed. Bullard delivered his opinion to the board on May 5, 1909.

The question of navigability was an important part of Bullard's legal opinion on the first of these two questions. Bullard wrote that since the Territorial Legislature called for the construction of a bridge over "any non-navigable stream" the Maricopa County Board was permitted to construct that bridge, even if it was entirely within the Tempe municipal limits. With regard to the second issue, Bullard ruled that the bridge question must receive a majority of all votes cast - thus the Tempe measure was defeated (Ex. No. 178).

County Attorney Bullard specifically examined the navigability of the Salt River in his opinion, since the question of its navigability had an effect on his ruling. Bullard noted: "The proposed bridge is to be constructed over a large

water-course, to wit, a large non-navigable stream" (Ex. No. 164). Since the territorial legislation permitted the construction of bridges across non-navigable streams, and since the Salt River was non-navigable, the county was allowed to construct the bridge - even if it was located within the boundaries of a municipality.

Maricopa County proceeded to construct the Center Street (later known as Central Avenue) bridge in due course. It was formally opened to traffic on June 28, 1911. After a brief ceremony on that date, "without fuss or feathers, the bridge was turned over to the people of the Salt River Valley" (Ex. No. 158).

The discussions of navigability with regard to the Central Avenue Bridge just prior to statehood provide a good understanding of how Arizona's territorial and county officials perceived the navigability issue for the Salt River at the time of statehood. First and foremost, the 25th Territorial Legislature adopted enabling legislation for Arizona counties to erect bridges across non-navigable streams.

Subsequent to the action of the Territorial Legislature, the Maricopa County Board of Supervisors referred the three bridge questions to the voters. In its action, the Board determined that the Salt and Agua Fria Rivers were non-navigable. Each ballot measure clearly indicated to the voters that the Salt and Agua Fria Rivers were non-navigable. The voters of Maricopa County, at an election, voted on the bridge questions that clearly showed the two rivers were non-navigable. Subsequent to the election, the Maricopa County Attorney issued a public ruling that verified the Salt River was non-navigable (Ex. No. 178).

3. No Evidence for Commercial Trade or Travel on the Lower Salt River

There is no historical evidence to suggest that the Salt River was used for commercial trade or travel at the time of statehood in 1912. Historically, the Salt River has been a barrier to transportation, not a corridor of transportation. Prior to statehood private entrepreneurs and government entities went to considerable expense to find ways to cross the obstacle of the Salt River. The use of ferries to cross the river during periods of high water is not considered evidence of commercial trade or travel on the Salt River. The use of ferries to cross the river was a mere adjunct to surface transportation. As land transportation improved, and as more and more water was removed from the Salt River for irrigation, the temporary and occasional use of ferries declined. The last known use of a ferry on the Salt River occurred in 1909, according to information compiled by Elaine Lacy, et. al. and Mona McCrosky (Ex. Nos. 2 and 128).

With regard to the susceptibility of the Salt River for commercial trade or travel, it is clear from the historical record that the river was not susceptible to such use. The final navigability study issued in December of 1993 by State Land Department "SLD" contractor CH2M Hill documents a mere sixteen attempts at navigation use of the Salt River (submittal #96-002-001-001; hereafter referred to

as SLD navigability study). These attempts ended in failure, or occurred only during flood events.

In contrast to the Salt River, the Colorado River which forms Arizona's border with California was susceptible to navigation and was used for both commercial trade and travel during this same time period. The navigation use of the Colorado is documented in Richard Lingenfelter's book, *Steamboats on the Colorado* (Ex. No. 179). Had the Salt River shared characteristics of navigability with the Colorado River a short distance away, it is clear that Arizonans had both the means and the technology to utilize the Salt River in a similar fashion. There was not sufficient water and flows were too erratic for such a use, and, as a consequence, the Salt River was not used for navigation.

In contrast to the Colorado, there is no evidence of any sustained trade or travel, in either an upstream or a downstream direction, on the Salt River in the years prior to statehood in 1912. The SLD navigability study documented sixteen boating attempts on the Salt River. These repeated, unsuccessful attempts at trade and travel are strong evidence that the residents of the Salt River Valley tried to navigate the Salt River but were unable to do so. The separate attempts show no pattern of sustained use. The boating attempts are in the nature of experiments during times of periodic high water.

The recorded boating attempts took place during floods for the most part. Table #2 correlates the date of the boating attempt and the condition of the river at the time of the incident. The river conditions were documented in the work edited by William D. Sellers, Arizona Climate (Ex. No. 181). The comparison indicates that several of the attempts took place during times of high water.

TABLE # 2

BOATING ATTEMPTS CORRELATED WITH CLIMATE / RIVER CONDITIONS

DATE OF ATTEMPT	EXHIBIT NO.	CLIMATE/RIVER CONDITIONS
May 3, 1873	85	No information available
June 14-18, 1873	86-88	No information available
February 17, 1881	89	No information available
November 30-December 3, 1881	90-91	No information available
February 14, 1883	92	No information available
June 3-6, 1885	93-95	No information available
June 8, 1885	96	No information available
December 12, 1888	97	No information available

TABLE # 2		
BOATING ATTEMPTS CORRELATED WITH CLIMATE / RIVER CONDITIONS		
DATE OF ATTEMPT	EXHIBIT NO.	CLIMATE/RIVER CONDITIONS
January 24, 1889	98	No information available
February 18-25, 1895	99-100	No information available
February 5, 1905	101	33 month wet period begins
March 24-29, 1905	102-103	Major flood begins on March 20
December 9, 1905	104	Major flood begins on November 28
October 4, 1909	105	No information available
June 28, 1910	106	No information available
January 30, 1915	107	35-month wet period begins, flood

The boating attempts were so infrequent during non-flood times as to be newsworthy. The fact that such attempts took place on the Salt River at all was so unusual that they merited notice in the newspaper. These trips were curiosities. Arizona historian Mona McCrosky noted with reference to the Gila River: "at times their efforts to simply cross it proved as newsworthy as their exploits in traversing its length. Few who chronicled these adventures took desert navigation very seriously, and accounts were often exaggerated and humorous" (Ex. No. 128). With specific reference to the Salt River, Lacey, et. al. note: "The fact that such attempts were recorded in the local newspapers shows that such incidences were rare, often dangerous, and thus newsworthy" (Ex. No. 2).

The number of recorded attempts at boating in the Salt River is very small given the span of time prior to statehood. In comparison to a true navigable river, such as the Colorado, the boating accounts for the Salt River are very few in number. Richard E. Lingenfelter, in his historical examination of river navigation titled *Steamboats on the Colorado*, lists twenty-four steamboats which regularly plied the waters of the Colorado. In addition, Lingenfelter lists twenty-six gasoline boats, fifteen barges, six dredges, and one sloop which navigated the Colorado River. This makes a total of seventy-two named vessels identified for the Colorado. Note that these are just the number of individual vessels identified, and not the number of times the vessels navigated the Colorado. In contrast, for the Salt River, the SLD navigability study identified only sixteen *attempts* (not vessels). The list of vessels identified by Lingenfelter is included as Ex. No. 179.

Although the SLD navigability study identified sixteen separate attempts to use boats on the Salt River, only two could be considered effective in a downstream

direction. No attempts took place in an upstream direction. The first downstream travel attempt occurred in 1873, thirty-nine years prior to statehood and before substantial amounts of water had been removed from the river for irrigation use. The second occurred in 1885, twenty-seven years before statehood. This second attempt was exploratory in nature with a view toward determining if commercial activity was possible. The planned commercial activity never took place, so one is left with the assumption that the result of the exploration was an understanding that the Salt River was non-navigable for commercial purposes. Of the remaining fourteen attempts, these were: (1) unsuccessful; (2) performed at flood stage; (3) not for commercial purposes; or (4) outside of the Granite Reef to Gila confluence portion of the Salt River. Table #3 provides a list of the sixteen attempts and a brief description of the results.

TABLE # 3

DESCRIPTION OF BOATING ATTEMPTS

DATE OF ATTEMPT	EXHIBIT NO.	DESCRIPTION
May 3, 1873	85	Utilized Canal for Portion
June 14-18, 1873	86-88	Unsuccessful
February 17, 1881	89	No Indication Trip Was Made
November 30-December 3, 1881	90-91	No Commercial Purpose, Recreational
February 14, 1883	92	No Commercial Purpose, Recreational
June 3-6, 1885	93-95	Exploration
June 8, 1885	96	Journey Made on Foot
December 12, 1888	97	No commercial purpose
January 24, 1889	98	Unsuccessful
February 18-25, 1895	99-100	Exploration
February 5, 1905	101	Flood Stage Rescue
March 24-29, 1905	102-103	Flood Stage, No Commercial Purpose, Recreational
December 9, 1905	104	Shipwrecked Twice
October 4, 1909	105	Very Difficult Journey
June 28, 1910	106	Above Granite Reef, Recreational
January 30, 1915	107	Flood Stage Rescue

In summary, these sixteen attempts provide no historical evidence that the Salt River was ever used for a commercial enterprise involving trade and travel. The occasional experimental use of the river shows that these events were non-commercial in nature. There are simply no records which show any commercial use of the river for trade or travel.

Had the river been navigable, one would expect to find docks, boat ramps, and landings associated with the river in Phoenix or the surrounding communities. There is no historical evidence for these facilities associated with river navigation in the Salt River valley. An examination of the Sanborn fire insurance maps for Phoenix and Tempe shows no commercial activity related to river transportation along the banks of the Salt River (Ex. No. 167).

Beyond these riverside facilities which one would expect to be located in close association with a navigable river, other types of facilities would be expected outside of the immediate riverbank. These would include such businesses as shipyards, naval supply merchants, and naval warehouses. An examination of the Sanborn maps shows there is no historical evidence for these navigation-associated businesses beyond the banks of the Salt River in either Phoenix or Tempe (Ex. No. 167).

4. The Salt River was an Impediment to Transportation, Not an Avenue of Transportation

Through its history the Salt River has been considered an obstacle to transportation, not an avenue of transportation. Rather than serving as a highway of commerce, the Salt River impeded and obstructed trade and travel in the region. Cross-river transportation mechanisms provide evidence that the Salt River was not navigable prior to statehood. These included fords, ferries, railroad bridges, and vehicular bridges.

An experience of two Phoenix residents underscores the perception of the Salt River as an obstacle to transportation. In 1909, Claude Brower and George Chitwood attempted to cross the Salt River at the Heard Crossing, what they thought was the "usual ford" of the river. Either by miscalculation of the ford's location, or by unusually high water, the two men and their buggy were overturned by the current. This "close call" convinced the two men that a bridge was needed across the Salt River (Ex. Nos. 135 & 147).

The presence of established river fords on the Salt River provides evidence that the water was frequently low enough to walk across, either on foot or horseback. There were several such regular fords of the Salt River. The locations of these fords are reproduced in a map prepared by David F. Myrick to accompany his book *Railroads of Arizona, Volume 2*. Myrick shows three fords across the Salt River in 1871: Wilson Crossing, Gray Crossing, and Maricopa (Stage) Crossing. These regular fords, present as early as 1871, provide a clear indication of the low

flow in the Salt River. The Gray Crossing, located due south of Phoenix, later became known as Heard Crossing after Dwight B. Heard acquired the extensive Michael Wormser land holdings south of the river (Ex. No. 189).

The first bridge over the Salt River was constructed in 1887 by the Phoenix and Maricopa Railroad. This was a branch line from the Southern Pacific Railroad main line at Maricopa. The 1887 bridge consisted of two large trestles with three 150' truss spans over the river. The trestle portion of the bridge was constructed of timber piles topped with wooden "bents" that formed an impassable obstacle to any transportation under the trestle portion of the bridge. The bridge was damaged in the flood of February, 1890, but re-constructed and back in service by March of 1890. The Phoenix and Maricopa Bridge was destroyed one year later, in the massive flood of February, 1891 (Ex. No. 190).

A new bridge was constructed by August of 1891, consisting of eight 150' truss spans, with pile and bent trestles on each side of the spans. In 1902 one of these spans failed, but was quickly replaced. Plans for a replacement bridge were announced in the summer of 1903, but construction moved forward slowly because of flood conditions in the Salt River. The new span opened in August of 1905, moved slightly west to improve the alignment of the railroad. The 1905 bridge consisted of two 100' foot spans, five 150' spans, and two 160' foot spans with wooden pile and bent trestles on both approaches. In August of 1912, plans were announced to replace the trusses with nine thru-trusses of heavier gauge steel. The replacement project was completed in 1913 (Ex. No. 190).

In 1903, a second railroad line was extended across the Salt River. The Phoenix and Eastern Railroad, an affiliate of the Santa Fe Railway, completed a pile and bent trestle bridge across the Salt River in January of that year. This pile and bent bridge would have effectively blocked all navigation on the Salt River, had there been any river navigation. By April of 1903, the Phoenix and Eastern had poured cement piles to support a planned thru-truss bridge. Construction of the steel bridge began on November 30, 1903. Completed in January of 1904, the new bridge consisted of four 200' truss spans and one 150' truss span. Trestle approaches were constructed on either side of the truss portion of the bridge (Ex. No. 190).

The new Phoenix and Eastern Bridge was damaged in a flood during March of 1905. The railroad quickly put in a temporary trestle bridge across the Salt River, consisting of piles and bents. This construction again blocked any potential navigation on the Salt River. During the summer of 1905, a new steel bridge for the Phoenix and Eastern was constructed to the west of the location of the first steel bridge. This second bridge was damaged during a flood in November of 1905. Subsequently, the Phoenix and Eastern again used a temporary trestle bridge of piles and bents, thus blocking the Salt River from any potential

navigation. The temporary bridge was used until November of 1906 when repairs on the damaged bridge were complete (Ex. No. 190).

These extensive and repeated railroad bridge construction efforts across the Salt River provide ample evidence that the Salt River was an impediment to transportation, and not an avenue of commerce. In themselves, these structures were serious impediments to navigation. The pile and bent trestle portions of the bridges, as well as the temporary pile and bent trestles completely crossing the Salt River, would have prevented any vessel from passing upstream or downstream at that location. The existence of these structures provides additional evidence that the Salt River was non-navigable.

Had the Salt River been considered a navigable stream, the construction of impediments in the riverbed would have to conform to the requirements of the Rivers and Harbors Act of 1899 which precluded the placement of any obstacle to transportation in a navigable river. There is no evidence that the construction of railroad bridges across the Salt River were designed to mitigate any impact on river transportation. Instead, the bridges blocked river transportation. Since there was no river transportation and the river was non-navigable, the bridge engineers did not need to factor river transportation into their plans. There is no evidence that river transportation was considered in the railroad bridge construction plans.

In addition to railroad bridge construction, the status of the Salt River as an impediment to transportation led to repeated demands for the construction of vehicular bridges across the Salt River. The campaign to construct a bridge at Central Avenue and the Salt River has already been described in an earlier section of this report. The Central Avenue Bridge was completed in 1911, blocking any potential river traffic at that location.

Tempe residents also pushed plans for a bridge across the Salt River during the period prior to statehood in 1912. Tempe bridge boosters, disappointed at the narrow defeat of their bridge proposition in the election of 1909, took comfort in an alternate plan for bridge construction. This alternate plan also originated with the Territorial Legislature, which in 1909 had passed enabling legislation for the construction of bridges across non-navigable rivers in Arizona.

The twenty-fifth Territorial Legislature established a state road tax in 1909 and created the office of Territorial Engineer. J.B. Girand was appointed to the position and quickly undertook plans to improve road transportation in Arizona, including a bridge across the Salt River at Tempe. In February of 1911, Girand took his plans for the Tempe Bridge to the Territorial Board of Control which approved the plans. Construction began on the Tempe Bridge in June of 1911. The construction of the bridge is unusual because prisoners were used as labor on the job. An average force of 250 convicts worked on the bridge from June of 1911 until September of 1913 when the construction project was completed. Known

later as the Ash Avenue Bridge, this structure stood across the Salt River until 1990 when it was removed as part of Tempe's Rio Salado project (Ex. No. 191).

The presence of vehicular bridges across the Salt River provides further evidence that the river was an impediment to transportation, and not an avenue of commerce. These structures were needed to facilitate transportation in the Salt River Valley. Vehicular bridges provide evidence that the Salt River was not navigable because their presence shows the need for forms of transportation other than by rivers. In addition, the bridges themselves were impediments to navigation.

5. The Salt River Was Not a Highway for Commerce

The relatively flat terrain of the Salt River Valley easily lends itself to land transportation. The lack of natural vegetation and absence of geographic obstacles (with the one exception of the Salt River) offered no incentive for the development of river-based forms of transportation. There is no evidence that transportation was normally undertaken by boat on the Salt River.

In contrast to the lack of evidence for river navigation, there is ample evidence that land transportation was the normal means of moving people and cargo from one place to another in Arizona. Land transportation was of such significance that Arizona's territorial and county governments devoted considerable time and money to the development and improvement of land transportation.

As early as 1864, one year after the creation of the Arizona Territory, the Territorial Legislature authorized private companies to build roads and charge tolls. Two years later, in 1866, the territorial government authorized counties in Arizona to create road districts. Between 1870 and 1885, the territorial government issued $85,000 in bonds for road construction. Just prior to statehood, in 1909, the Territorial Legislature created the office of Territorial Engineer and embarked on a major road construction program. By the time Arizona was admitted to statehood on February 14, 1912, the territory had constructed over 243 miles of highway at an average cost of $2,500 per mile (Ex. No. 193).

The most telling evidence in support of a finding of non-navigability with reference to transportation is the construction of the Apache Trail to the site of Roosevelt Dam at the confluence of Tonto Creek with the Salt River. The construction of the dam in this remote section of the Salt River entailed the movement of large amounts of equipment and large numbers of men. In order to reach the dam site, the Federal government constructed a wagon trail from Mesa to the site of the dam. The construction work started in December of 1903 and was very difficult. Cost estimates for the Apache Trail reached $25,000 per mile. Had the Salt River been a navigable stream at this time, it would have provided a safe and less expensive alternative means of transportation to the site of the dam. Rather than attempt transportation by river, the Federal government laboriously

constructed an expensive wagon road which closely paralleled the Salt River to the site of the dam (Ex. No. 37).

6. Historic Condition of the Salt River

Mary Austin wrote in her book *Land of Little Rain* that "It is the proper destiny of every considerable stream in the west to become an irrigating ditch." Water is the most precious natural resource in the arid environment of Arizona. At the time of statehood, diversions of water for beneficial use frequently consumed the entire flow of the Salt River. With the completion of Roosevelt Dam in 1911, flood flows of the Salt River were captured and stored for later beneficial use.

Well before the completion of Granite Reef Dam in 1908 and Roosevelt Dam in 1911, diversions of water for agriculture frequently consumed the entire flow of the Salt River. Because there was more demand for water than water available, agricultural use of water from the Salt River has been actively litigated on numerous occasions in the years prior to and since statehood. These numerous court cases, which frequently concern a lack of adequate water for irrigation, effectively demonstrate that the ordinary and natural condition of the Salt River was to serve as a source of irrigation water for reclaiming the arid desert lands of the Salt River Valley. No historical evidence has been found indicating that any water in the river was allocated to or reserved for navigation purposes.

The Salt River Valley is home to one of the first reclamation projects created under the provisions of the 1902 Reclamation Act. Named the Salt River Project after the river of the same name, this reclamation project utilized diversions from the Salt River to irrigate and reclaim arid desert lands. The main purpose of the dam was to store excess flood flows of water so that stored water could be released gradually in times of drought to furnish water for agricultural pursuits

Prior to the construction of dams on the Salt River for the purpose of storing flood flows for later irrigation use, the Federal government conducted extensive studies of the Salt River. One goal of those studies was to determine if the Salt River could be considered navigable, and its waters thus important for uses in addition to irrigation. The Department's Army Corps of Engineers was responsible for regulating construction on navigable rivers such as the Colorado so that no impediments to travel were created.

In 1894, the War Department received an inquiry regarding the navigability of streams tributary to the Colorado River. The Army Corps of Engineers was asked to determine if the construction of dams on the Salt River would impede navigability. In response, Lt. Col. W.H. Benyaurd of the Army Corps of Engineers determined that the Gila, Salt, and their tributaries "are not navigable waters of the United States." In 1895, the Judge Advocate General of the War Department, in forwarding the Army Corps finding to the Secretary of War, noted

"the Gila, Salt and their tributaries are in no sense navigable streams" (Emphasis in original; Ex. No. 32).

Prior to the construction of Roosevelt Dam, the Federal government needed to "withdraw" (remove from public entry under the Homestead Act or Desert Land Act) many acres of land in the vicinity of the dam and along the Salt and Verde rivers. In 1903, the Director of the US Reclamation Service requested that the Secretary of the Interior withdraw lands in the vicinity of the dam and along the Salt and Verde rivers to allow construction to proceed. The director noted, the land "will be needed for the purpose of dams, power canals, transmission lines, and other irrigation works." It is noteworthy that the description of uses did not include transportation by river navigation (Ex. No. 39).

One of the major concerns for US Reclamation Service engineers during the era of statehood was to establish the amount of acreage that could be successfully irrigated with waters stored behind Roosevelt Dam. In August of 1913 A.A. Jones, Assistant Secretary of Interior, proposed a "Board of Survey" to determine which lands in the Salt River Valley would be eligible to receive water diverted from the Salt River with Roosevelt Dam in place as part of the Federal reclamation project. The Board of Survey completed its work effort in August of 1914. It found that more 180,000 acres of land could be served with the reservoir in place (Ex. No. 186).

The final cost of the initial phase of construction for the Salt River Project was set at over $10 million in 1915. This sum represents a considerable investment on the part of the Federal government to irrigate the 180,000 acres of the Salt River reclamation project. It is also strong evidence that the Federal government considered the Salt River as non-navigable. There is no historical evidence that the Federal government ever expended any funds to improve navigation on the Salt River.

In addition to diversions of water from the Salt River for the Federal reclamation project, the Federal government also used the Salt Rivers to provide water to Indian reservations. Such diversions are inconsistent with navigability. Waters were diverted from the Salt River for the purpose of irrigating the Salt River Pima-Maricopa Indian reservation.

The Salt River Pima-Maricopa Indian Reservation was created by executive order in 1879. An initial executive order on January 10, 1879, established a very large reservation. This order was subsequently modified on June 14, 1879. The June executive order established the boundaries of the current reservation east of Scottsdale and north of Mesa (Ex. No. 187).

This reservation was home to Native Americans who had traveled from the Gila River Indian Reservation in search of water due to a lack of irrigation water on the Gila River Reservation. As early as 1871, Pima and Maricopa Indians had

moved off the Gila River Reservation and into the Salt River Valley in search of irrigation water. By the time of statehood in 1912, the Pima and Maricopa Indians had a forty-year history of water use in the Salt River Valley. This use of water diverted from the Salt River for irrigation was recognized in the Kent Decree of 1910. Judge Edward Kent ruled that Indians on the Salt River Reservation were entitled to use 700 miners inches of water (17.5 CFS) from the Salt River (Ex. No. 177).

In later years, well after statehood, the Federal government reaffirmed its commitment to provide irrigation water diverted from the Salt River for the benefit of Indians living on the Salt River Reservation. On June 3, 1935, the United States entered into a contract with the Salt River Valley Water Users Association (SRVWUA - a.k.a. Salt River Project) for the construction of Bartlett Dam on the Verde River. At that time the SRVWUA was in the process of planning this additional water storage dam for the benefit of water users in the Salt River Valley. The Federal government agreed to assume twenty per cent of the cost of constructing Barlett Dam to provide additional water for use on the Salt River Indian Reservation (Ex. No. 188).

The recognition of Indian water rights in the Kent Decree and the subsequent funding of Bartlett Dam to further guarantee those water rights is ample evidence that the ordinary and natural condition of the Salt River included supplying water for use on the Salt River Indian Reservation. This water use, and the expenditures by the Federal government to guarantee those water rights, is inconsistent with the use of the Salt River for navigation. Water in the Salt River was highly valuable for irrigation use on the Indian Reservation. While there is evidence that the Federal government took steps to continue the use of irrigation water on the reservation, there is no historical evidence that the Federal government took any steps to protect or further transportation on the Salt River.

7. Water Diversion Structures Were Impediments to Navigation

The construction of numerous water diversion structures on the Salt River prior to statehood provides further evidence that the river was not navigable. These structures varied in size and type of construction from simple rock, brush and timber dams to concrete dams like Granite Reef Dam. These diversion structures impact navigability in two main ways. First, their physical presence would have acted as a barrier to travel in the river. Second, these dams diverted flow from the river thus reducing the amount of water for transportation.

The degree to which diversion structures acted as physical barriers to travel along the river is difficult to answer especially since few anecdotal references to travel on the river exist. Furthermore, the extent to which these dams create a physical barrier is dependent upon how much water is flowing in the river on any given day. These types of records are scarce especially downstream from Granite Reef Dam.

The impact of diversions on the amount of water available for navigation is clearer. Effects on Salt River flows from these diversions are detailed in several different documents. A.P Davis reported in 1897 that aggregate canal capacity was in excess of low flow in the river (Ex. No. 205). W.H. Code reported in 1900 that the entire flow of the Salt River was diverted into the Arizona Canal at the Arizona Dam. The Salt River was reported as being dry from the head of the Utah Canal for 6 or 7 miles downstream. After that point irrigation return flow supported flow in the river until Joint Head Dam, which was located at approximately present day 40th St. and the Salt River, where the entire flow was again diverted. This pattern is repeated to some extent below Joint Head Dam where irrigation return flows, groundwater discharge and ephemeral tributaries reinstitute flow in the river. There were additional small canals between Joint Head Dam and the Salt-Gila confluence that diverted these flows. Diversions of flow which caused stretches of the river to dry up followed by flowing reaches supported by return flows and groundwater discharge is also described in the Kent Decree (Ex. No. 177). This same pattern is described in other documents such as Ex. No. 34, Ex. No. 40, and Ex. No. 192.

It is beyond question that significant reaches of the Salt River were dry and contained no flow at certain times of the year. This evidence supports a conclusion that the river was non-navigable.

8. Characteristics of the Salt River Channel at Statehood

Several historical channel characteristics of the Salt River at the time of statehood precluded the use of the river for navigation. Characteristics such as the type of vegetation present in the river bottom, the size and shape of the river channel, and the amount of water flow in the river were individual factors that precluded navigation. Riparian vegetation was too dense, the channel too shallow and unstable, and the flow too variable to support navigation. Taken together, these three characteristics effectively prevented any use of the river as a highway of trade or commerce.

Vegetation

While the channel of the Salt River today is a barren expanse of sand, the historical channel contained numerous sloughs and considerable riparian vegetation. The presence of such dense vegetation would have two effects on navigation: first, the vegetation would further reduce streamflow in times of low flow, and second, its presence, especially when dense, would impede navigation.

Two accounts describe dense vegetation in the Salt River, the first a summary of historic conditions and the second a description contemporaneous with statehood:

> "Prior to dam construction in the early 1900's, the Salt River riparian vegetation was dominated by cottonwood, willow and the various

species of mesquite trees. Mesquites occurred along the outer bank of the river and defined the outer edge of the natural riparian vegetation zone. Willow and cottonwoods were located inward of the mesquites, adjacent to the river bottom and closer to where there was a more continuous flow of water. Some channel areas were barren, while others had vegetation in strips along the river bottom and in abandoned high flow channels. The historic bottom lands of the Salt River valley supported a variety of vegetation, including trees, shrubs, marsh plants and some grasses. Beyond the cottonwoods and willows, grew alders on the margins of the river and Palo Verde. Sagebrush joined the mesquite on the low riverside terraces. Vegetation grew so densely in some places it was impossible to cross the bottom lands, while in other locations vegetation was open and more scattered. There were several species of fish in the river's waters, similar to those found in the lower Gila River" (emphasis added; Ex. No. 208).

"We found the river bottoms, as a rule, thick with chemisal, relieved here and there by dense mesquite groves, looking in the distance like old orchards, through which it was almost impossible to penetrate with ambulance or wagon. Now and then we had to flank a slough, or flounder through a quicksand..." (emphasis added; Ex. No. 209).

These accounts show that the dense riparian vegetation present at statehood acted as an impediment to navigation. The accounts also provide evidence that transportation in the vicinity of the river bed was not by boat, but rather by foot or horseback. Furthermore, the dense vegetation hampered even these pedestrian forms of transport.

Geomorphology

The channel of the river at statehood was significantly different than the channel that is visible today. Today's channel is relatively straight, deeply entrenched due to flooding and flood control efforts, devoid of vegetation, and dry except in times of rainfall or floods. In contrast, the historic Salt River, like many arid streams, was characterized by braided channel morphology.

Braided streams are generally broad and shallow, with channels diverging and joining amidst low-lying islands or sandbars. Stream sediments tend to be composed of coarser sands and gravels (evidenced by the number of gravel mines operating today) that constantly shift in response to the current. Such streams are characterized by high bank erosion rates, excessive deposition, and annual shifts of the bed location. Conditions contributing to channel braiding include a high sediment supply, high bank erodibility, and very flashy runoff conditions which can vary rapidly from a base flow to an over-bank flow on a frequent basis.

The low flow channel of the Salt River was tortuously meandering, as described in the following historical account:

> "...this ended in a bend of the Salt, and from there on all was wild and unbroken—a veritable terra incognita. We found the Salt crookeder than a ram's horn, or a mesquite tree, or anything else that is most crooked and involved. Laying our course partly by the compass, and partly by the Salt's fringe of cottonwoods, we struck across from bend to bend of the river, sure only of one thing, and that was-keeping near to water..." (Ex. No. 209).

Braided channels are unstable, characterized by rapidly shifting bed material and continuous shifting of the river course. These rivers are very sensitive to disturbances such as flood flows, which have the result of changing the location of river channels after each flood incident, and have poor recovery potential, meaning that they seldom return to their pre-flood channel. The instability of braided streams such as the Salt River render them unsuitable for navigation. Compounding this situation is that the sediment load of braided streams is high (Ex. No. 210). The historic Salt River was a depositional stream, with a heavy load of silt. This resulted in localized, frequently spaced sandbars and "islands" that prevented travel by river. This fertile sediment further contributed to riparian growth which also impeded navigation on the river.

The historic Salt River was often referred to as a slough rather than a river. A slough is defined as a depression or hollow, usually filled with deep mud or mire, or a stagnant swamp, marsh, bog, or pond. Testimony from the 1926 Maricopa County Superior Court case of McDonald v. Perry and City of Phoenix provides an illustration of channel conditions of the Salt River at statehood:

> "...the discharge in what was originally the old channel of the Salt River in the slough there. At the time I made my ditch [in 1913], that was quite a slough; quite a lagoon there down about a quarter of a mile from this point. ...the discharge was made here into this slough and continued on down, a continuation of the slough. Some of it diverged in different directions, small quantities to form little lagoons ...that whole country [the Salt River bed] was a bog hole...and a jack-rabbit couldn't get in there. I have been bogged down there with a saddle horse. I couldn't get in." (Ex. No. 211)

General Land Office (GLO) survey maps provide a visual depiction of the sloughs and meandering channels in the Salt River. While the earliest maps date to 1870, conditions in the Salt River at statehood were very similar to the earliest GLO maps. Exhibit No. 212 shows early depictions of the Salt River as mapped by the General Land Office. This first depiction showed that river was not a uniform single channel, but consisted of a series of sloughs and meandering channels.

Subsequent maps show that while locations of individual sloughs and meander channels changed, the braided channel conditions that characterized the Salt River remained remarkably consistent over time. Exhibit No. 213 is an excerpt from a portion of a 1904 United States Reclamation Service map of the Salt River Valley. This map shows a number of meandering channels and sloughs in the vicinity of Range 1 east, Township 1 north. A later map, prepared by the Indian Irrigation Service in 1915 from survey information collected in 1914, shows the same braided conditions contemporaneous with statehood (Ex. No. 214). This map is also significant because it clearly shows the sandbars and islands typical of a meandering stream. These conditions precluded navigation of the Salt River at the time of statehood.

Flow Regime

The lower Salt River was originally a perennial stream, fed by snowmelt from the mountains to the east and northeast. Flows in the river had a seasonal pattern, with the highest flows occurring in December and January and the lowest in October. The Salt River is a typical desert stream in that its flow fluctuates wildly in response to precipitation and varies greatly from month to month and year to year. John Wesley Powell determined that the Salt River had the greatest variability between low and high flows of 29 western rivers he studied (Ex. No. 3).

A reconstructed hydrograph of the Salt River shows flow prior to construction of Roosevelt Dam (Ex. No. 215). The hydrograph was constructed from daily flow data measured at two gauging stations: Salt River at McDowell, located about a mile upstream of the confluence with the Verde River, and Verde River below Bartlett Reservoir. Adding these two flows together gives an estimate of flow in the Salt River below the confluence with the Verde. This hydrograph shows that daily flow was usually well below 2,000 cfs and flood flows were several times greater—a feast or famine condition not conducive to navigability. Despite the regulating effect resulting from the completion of Granite Reef Dam in 1908 and Roosevelt Dam in 1911, the fluctuation pattern of river flows continued even after statehood. A wildly fluctuating river such as the Salt was not a corridor for water transportation.

Arid streams, such as the Salt River, have flow patterns that change with the amount of water available in the stream. Normally, water flows in single meandering channel (the low flow channel). As flow increases, water begins to flow in two parallel channels then in a wider, braided channel. At very high flows, such as flood flows, the water inundates the entire channel (the high flow channel) and exhibits sheet-like, or overland, flow. This means that a higher flow does not produce a deeper or faster-moving stream.

Exhibit No. 212 is a map filed with the Land Office in Prescott in 1870. It shows the Salt River having two distinct channels—the North Channel and the South Channel—as well as numerous sloughs off both these channels. At the

lowest—and most frequent—flows, only the North Channel would be flowing. As flows increased, the South Channel would begin to flow. At flood flows, both channels would be inundated and the Salt River would be a single, wide watercourse. In no case, however, would the flow support navigation.

9. Federal Actions Contemporaneous with Arizona Statehood Support a Determination that the Salt River Was Not Navigable

The most curious aspect of the entire navigability question is the premise that Arizona rivers other than the Colorado were somehow overlooked when it came time to evaluating their navigability during the historic period. In fact, Arizona rivers were examined and found wanting in the area of navigability. The Rivers and Harbors Act of 1899 (30. Stat. 1121) lists many rivers in the United States that were navigable and thus eligible for Federal funding of improvements. The list does not include the Salt River (Ex. No. 194).

Prior to the Rivers and Harbors Act of 1899, the Bureau of the Census published a statistical atlas of the United States. Published in 1898 and compiled from information gathered during the 11th census in 1890, the atlas contains a depiction through the means of notations marked on the navigable rivers of the United States. This depiction is reproduced as "Plate 59" of the statistical atlas. The Colorado is the only Arizona river marked as navigable in 1890. Had other rivers in Arizona been considered navigable, they would have been so designated in 1890. This evaluation took place a full twenty-two years prior to statehood when diversions for irrigation use were smaller and prior to the construction of dams and bridges which served as impediments to transportation (Ex. No. 195).

At the time of statehood in 1912, the Federal government granted Arizona 10,426,000 acres of land. This figure included lands along the navigable Colorado River. Lands along other Arizona rivers, not considered navigable in 1912, were not included in the amount of land granted to the new state government. The determination of navigable rivers according to the 1899 statute, and the location of lands granted to Arizona in its Enabling Act along those rivers were deliberate and calculated decisions. The Salt River was not somehow overlooked in this deliberative process. It was excluded from consideration because it was considered non-navigable at the time of statehood (Ex. No. 196).

Conclusion

This report presents a historical and scientific analysis of evidence for navigation on the Salt River. Despite a considerable research effort, evidence supporting navigation on the Salt River was not located. In contrast, the research effort uncovered a considerable amount of evidence supporting the contention that the Salt River was not navigable. The report reaches the conclusion that the Salt River fails to possess any criteria supporting a finding of navigability.

Historical evidence documents that navigation of the Salt River was attempted, but those attempts ended in failure. Contemporary accounts of the Salt River at the time of statehood describe it as a non-navigable stream. Extensive historical research has failed to uncover any evidence that would contradict that contemporary assessment.

Scientific evidence supports a finding of non-navigability. The conditions of the river at statehood were those of a river not suited for navigation. Riparian and riverbed vegetation was in places too thick to pass through. The river had a braided channel with numerous islands and sandbars. At low flow, water flowed in only one channel, which was so shallow it was often described as a bog or slough. At higher flows the river was still too shallow for navigation, since the water spread out into the other channels. Flow in the Salt River was too variable to reliably support navigation.

TABLE # 4	
List of Exhibits Cited in 2003 Phoenix Report and Filed Previously with ANSAC	
Exhibit #	Description
002	*A Historical Analysis of Portions of the Salt and Gila Rivers, Arizona* prepared by Elaine C. Lacy, dated February, 1987.
003	*An Historical Analysis of the Salt River 1830-1912*, Prepared by Barbara Behan, Dated 5/12/88
006	Hurley v. Abbott - Action to Quiet Title
007	Hurley v. Abbott - Amended Complaint
008	Hurley v. Abbott - Answer of H. Criswell
009	Hurley v. Abbott - Answer and Cross Complaint of United States of America
010	Hurley v. Abbott - Answer of Lou Perkins
011	Consolidated Canal Company v. Tempe Irrigation Canal Company - Answer of Tempe Irrigation Canal Company
012	Consolidated Canal Company v. The Arizona Canal Company, et. al. - Complaint dated June 16, 1894
013	Consolidated Canal Company v. The Arizona Canal Company, et. al. - Summons and Answer of Defendant M. Wormser
014	The Utah Canal Enlargement and Extension Company v. The Utah Irrigation Ditch Company, et. al. - Complaint
015	The Utah Canal Enlargement and Extension Company v. The London Company, et. al. - Complaint
016	The Consolidated Canal Company v. The Utah Enlargement and Extension Company - Complaint
017	The Consolidated Canal Company v. The Tempe Irrigation Canal Company - Amended Complaint
019	Consolidated Canal Company v. Arizona Canal Company - Complaint, dated August, 1894.
020	M. Wormser v. Charles T. Hayden - Complaint
021	Frank B. Austin v. A.J. Chandler, et. al. - Complaint
022	A.J. Peters v. The Consolidated Canal Company - Complaint
023	W.S. Johnson, et. al. v. The Consolidated Canal Company - Complaint
024	James C. Goodwin v. Granvill H. Oury - Complaint
025	James C. Goodwin v. Granvill H. Oury - Handwritten Complaint
026	C.A. Saylon, et. al. v. The Consolidated Canal Company - Complaint

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Exhibit #	Description
027	A.J. Peters, et. al. v. The Consolidated Canal Company - Complaint
028	L.L. Harmon, et. al. v. The Consolidated Canal Company - Complaint
029	J.C. Carmichael v. Bill Galbreath and John H. Ivy - Complaint
030	Vernon L. Clark, et. al. v. The Bartlett Heard Land and Cattle Company, et. al. - Amended Complaint
031	W.W. Dobson, et. al. v. James Johnson - Complaint
032	Correspondence from the Department of the Interior, General Land Office, Washington, D.C., dated October 5, 1894 and handwritten notes
034	*Ground Waters of Salt River Valley* (24 pages)
037	*Volume I, Arizona - Salt River Project Preliminary History* (8 pages)
039	Drafting Div. Files, Correspondence from the Director to the Secretary of the Interior, Washington D.C., report regarding entire canyon of the Salt River, Arizona will need irrigation works
040	Department of the Interior, Office of the Secretary of Reclamation Service, Salt River Project, Water Rights, August 2, 1912 to October 23, 1912 (26 pages)
085	*Weekly Arizona Miner*, May 3, 1873: flat boat with 5 tons of wheat floated down Salt River and Swilling Canal to Hellings Mill
086	*Weekly Arizona Miner*, June 14, 1873: Hayden investigating possibility of floating logs down the Salt
087	*Weekly Arizona Miner*, June 21, 1873: Hayden unsuccessful
088	*Weekly Arizona Miner*, June 28, 1873: Hayden unsuccessful
089	*Arizona Gazette*, February 17, 1881: Cotton and Bingham leave for Yuma in 18-foot skiff
090	*Arizona Gazette*, November 30, 1881: Yuma or Bust expedition via Salt River
091	*Arizona Gazette*, December 3, 1881: Yuma or Bust expedition, continued
092	*Arizona Gazette*, February 14, 1883: officers from Fort McDowell float down to Phoenix
093	*Arizona Gazette*, June 3, 1885: exploration of the Salt River Canyon by boat
094	*Arizona Gazette*, June 5, 1885: additional accounts of exploration of Salt River Canyon by boat
095	*Arizona Gazette*, June 6, 1885: interview with John Meaders, one of the explorers of the Salt River Canyon
096	*Arizona Gazette*, June 8, 1885: account of previous exploration of the Salt River Canyon, on foot, circa 1875

TABLE # 4	
List of Exhibits Cited in 2003 Phoenix Report and Filed Previously with ANSAC	
Exhibit #	Description
097	*Phoenix Daily Herald*, December 12, 1888: commandant of Fort McDowell killed during canoe trip from Fort McDowell to Phoenix
098	*Tombstone Daily Prospector*, January 24, 1889: ferry boat floated downstream from Maricopa Crossing to Gila River
099	*Phoenix Daily Herald*, February 18, 1895: account of boat trip down the Gila from Clifton to Sacaton then overland to Phoenix, then by boat down the Salt, Gila and Colorado
100	*Phoenix Daily Herald*, February 25, 1895: letter from boater (above), describing trip
101	*Arizona Republican*, February 5, 1905: use of boats to rescue Tilzer family from island in the Salt River during flood
102	*Arizona Republican*, March 24, 1905: Jacob Shively boats Salt River
103	*Arizona Republican*, March 29, 1905: Jacob Shively reaches Arlington
104	*Arizona Republican*, December 9, 1905: engineers use boat to inspect canals
105	*Arizona Republican*, October 4, 1909: Jim Meadows recounts boating the Salt between Livingstone and Tempe
106	*Arizona Republican*, June 28, 1910: two men boat from Roosevelt Dam to Tempe
107	*Arizona Gazette*, January 30, 1915: use of boats to rescue people from flooded Salt River
128	*The Smoke Signal*, 1988: The Great Ferry War of 1905 and Other Adventures on the Gila River, Arizona
135	"Lively Experience in the Salt River" *Arizona Republican*, April 19, 1909 (II, 3:4-5)
140	"Pass Bill to Purchase Fair" *Arizona Gazette* (Phoenix), March 16, 1909 (I, 1:3-4 & 5:3)
141	"Twenty-Fifth Legislature Adjourns at Six Thirty" *Arizona Gazette* (Phoenix), March 19, 1909 (I, 1:1-4)
146	"Bridge Question Before Board Supervisors" *Arizona Gazette* (Phoenix), April 19, 1909 (I, 1:3)
147	"Exciting Experience at the Heard Crossing" *Arizona Gazette* (Phoenix), April 19, 1909 (I, 11:3)
148	"Bridge Election Called for June 10" *Arizona Gazette* (Phoenix), April 20, 1909 (I, 5:4)
158	"Dedication of Center Bridge" *Arizona Gazette* (Phoenix), June 29, 1911 (I, 1:3)
162	*Session Laws of the Twenty-Fifth Legislative Assembly of the Territory of Arizona.* (Phoenix: Phoenix Printing Co. 1909), pp. 184-185 and pp. 208-211
163	*Minutes of the Maricopa County Board of Supervisors*, Book 9, pp. 18-21 (April 20, 1909) and Book 9, pp. 65-68 (June 21, 1909)

TABLE # 4	
List of Exhibits Cited in 2003 Phoenix Report and Filed Previously with ANSAC	
Exhibit #	Description
164	*Gerald A. Doyle & Associates, Ash Avenue Bridge (HAER No. AZ-29) Photographs, Written and Historical Data.* (San Francisco: National Park Service, 1991): Photocopies of Tempe News newspaper article dated April 3, 1908 and May 7, 1909 included in HAER field notes.
165	Decree in Case #708 Wormser, et. al. vs. Salt River Valley Canal Co., et. al.
167	Index to Sanborn Fire Insurance Co. maps for Phoenix and Tempe (dated 1911)
177	Decision and Decree in Case #4564, Hurley v. Abbott (1910)
178	"Two Bridge Questions" *Arizona Republican* , May 5, 1909 (I, 2: 1-4).
179	Excerpt from Richard D. Lingenfelter, *Steamboats on the Colorado.* University of Arizona Press.
181	Excerpt from William D. Sellers, ed., *Arizona Climate.* University of Arizona.
186	Excerpt from Karen L. Smith, *The Magnificent Experiment.* University of Arizona Press, 1986.
187	January 10, 1879, and June 14, 1879, Executive Orders establishing the Salt River Pima-Maricopa Indian Reservation.
188	Agreement Between the United States and the Salt River Valley Water Users Association, 1935.
189	Excerpted map from David F. Myrick, *Railroads of Arizona, Volume 2.*
190	Excerpted map from David F. Myrick, *Railroads of Arizona, Volume 2.*
191	Historic American Engineering Record report on Ash Avenue Bridge, 1991.
192	Excerpt from Willis T. Lee, 1905. "Underground Waters of the Salt River Valley", *USGS Water Supply Paper* No. 136 (Washington: Government Printing Office).
193	"Vehicular Bridges in Arizona" National Register of Historic Places nomination, 1987.
194	Excerpt from the Rivers and Harbors Act of 1899 (30 Stat. 1121).
195	Plate 59 from the 1890 Statistical Abstract of the United States (published 1898) showing navigable rivers in the United States.
196	Excerpt from 1971 report, *Ownership and Administration of Public Lands in Arizona.*
205	Excerpt from A.P. Davis, 1897. "Irrigation Near Phoenix, Arizona." *U.S. Geological Survey Water Supply and Irrigation Paper* No. 2 (Washington: Government Printing Office).

TABLE # 5	
Volume IV: Exhibits Filed by Phoenix with 2003 Report	
206	Current Resume of Douglas E. Kupel
207	Current Resume of Ellen G. Endebrock
208	Army Corps of Engineers Rio Salado Project Website
209	Title page from Thomas Edwin Farish, 1918: *History of Arizona, Volume VI*
210	Title page from David L. Rosgen, 1996: *Applied River Morphology.*
211	McDonald v. City of Phoenix, Abstract of Record, 1926
212	General Land Office Maps (A–D)
213	U.S. Bureau of Reclamation Map, 1904
214	Indian Irrigation Service Map, 1915
215	Reconstructed Daily Flow Hydrograph of Salt River, 1904-1909

Exhibit 206

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EDUCATION

Ph.D. - History, Arizona State University, Tempe (May, 1995)
Dissertation title: Urban Water in the Arid West: Municipal Water and Sewer Utilities in Phoenix, Arizona.

M.A. - History, University of Arizona, Tucson (May, 1986)
Thesis title: Diversity Through Adversity: Tucson Basin Water Control Since 1854.

Cert. - University of South Carolina, Columbia (May, 1981) (archaeology).

B.A. - History, University of Oregon, Eugene (March, 1979)

TEACHING EXPERIENCE

Courses taught:

Adjunct Professor, Arizona State University (Tempe)
Historical Resources Management
Adjunct Instructor, Gateway Community College (Phoenix)
Western Civilization since 1789
US History to 1870
US History Since 1870
Adjunct Instructor, Phoenix College
US History to 1870
US History Since 1870
Arizona History
History of Mexico
Western Civilization, Middle Ages to 1789

Certified Community College Instructor, Arizona
Subject areas: History and Anthropology

Courses qualified to teach:

U.S. History Survey (pre- & post- 1877), Western Civilization, Arizona History, American West, Native American, Urban History, Public History, Environmental History, Latin America.

PROFESSIONAL EXPERIENCE

City of Phoenix Law Department, Phoenix, Arizona (4-11-88 to present).

Historian for City Attorney's Office, Civil Division. Organized and directed historical research for litigation in the area of environmental law and natural resources. Main project is the Gila River Stream Adjudication, a large water rights lawsuit involving thousands of claimants. The adjudication is part of a team litigation effort under the direction of two attorneys and in conjunction with other technical experts, legal assistants, and administrative personnel. Other ongoing projects include research into the deregulation of the electrical utility industry, studies of telecommunications deregulation, an examination of the potential navigability of Arizona's rivers and streams, and research into wastewater treatment methods. This technical and analytical position entails the frequent preparation of oral and written reports on policy issues presented to top city management and elected officials.

Arizona State Historic Preservation Office, Phoenix, Arizona (1-27-86 to 4-8-88).

Historian for state agency, a division of Arizona State Parks. Coordinated National Register of Historic Places program. Reviewed, edited, and wrote National Register nominations. Reviewed Federal and state projects for compliance with applicable historic preservation legislation. Monitored historic preservation fund grant projects. Continue to serve Arizona State Parks in a volunteer capacity as a reviewer for its Arizona Heritage Fund Project grant applications.

Consulting Archaeologist and Historian (1979-1986)

During this seven-year period I worked on a large number of contract projects as a consulting historian and archaeologist. This project work included a wide variety of jobs and employers. Government employers included the National Park Service's Historic American Buildings Survey and Historic American Engineering Record, the University of Arizona, the Arizona Historical Society, the California State Department of Transportation, the California State Department of Parks and Recreation, and the State of Nevada Department of Transportation. Private employers included Cultural and Environmental Systems (Tucson), Linda Laird and Associates (Tucson), Acuna-Coffeen Landscape Architects (Tucson), TerraMar International Services (Tucson), Roth and Associates (San Diego), Wirth Environmental Services (San Diego), Larry Seeman Associates (Newport Beach, CA), Regional Environmental Consultants (San Diego), Carolina Archaeological Services (Columbia, South Carolina), Heritage Environmental Services (San Diego), Archaeological Planning Collaborative (San Diego), Paul G. Chase and Associates (Escondido, CA), and Multi-Systems Associates (San Diego).

COMMUNITY SERVICE

Arizona Humanities Council Grant Review Committee (1998-2000)
Arizona Preservation Foundation:
- Board Member, President, Vice-President (1987-1993)
Arizona State Parks Historic Preservation Advisory Committee (1995-2000)
City of Phoenix United Way Executive Committee (1993-1995)
Friends of Arizona Archives, Treasurer (1997-present)
Magnet Traditional School Advisory Council (1999-2000)
Magnet Traditional School PTO Vice-President (2002-2003)
Maricopa Association of Governments, TEA Grant Review Committee (1999, 2001-present)
Phoenix Elementary School District #1 Bilingual Education Committee (1996-1999)
Phoenix Boys Choir Fundraising Committee (1994-1996)

PROFESSIONAL AFFILIATIONS

Arizona Archaeological and Historical Society
Arizona Archaeological Society
Arizona Preservation Foundation (former President)
Arizona Historical Foundation
Arizona Historical Society
Coordinating Committee for History in Arizona
Friends of Arizona Archives (Treasurer)
National Council on Public History
National Trust for Historic Preservation
Organization of American Historians
Register of Professional Archaeologists (RPA - Registered Professional Archaeologist))
Society of Historical Archaeologists

HONORS AND AWARDS

2002 Designated scholar and speaker, *Parched Arizona: A Discussion of Fire and Drought*. Funded by the Arizona Humanities Council.

2001 Designated scholar and speaker, *Moving Waters: The Colorado River and the West*. An examination of land, laws, and stories in 22 Colorado River communities. Major funding by the National Endowment for the Humanities and the Ford Foundation.

2001 Research grant to prepare paper and presentation for the Arizona Territorial Justice Forum on land fraud in Arizona. Presented by the Arizona Humanities Council.

1999 Research grant to prepare paper and presentation for the Arizona Territorial Justice Forum on Mexican revolutionary Ricardo Flores Magón. Presented by the Arizona Humanities Council.

1998 Travel grant to conduct research at the American Heritage Center in Laramie, Wyoming. Presented by the University of Wyoming.

1997 Special recognition award for the best National Register of Historic Places nomination prepared in a multiple property format. Presented by the Arizona Historic Sites Review Committee.

1995 Special recognition award for the best National Register of Historic Places nomination prepared for a historical property. Presented by the Arizona Historic Sites Review Committee.

1994 James E. Officer prize for best paper on Arizona's Hispanic history at the Arizona Historical Convention. Presented by the Arizona Historical Society.

1987 Best paper delivered at the Arizona Historical Convention. Presented by the Arizona Historical Society.

1981 Full scholarship to the University of South Carolina. Presented by the Federal Highway Administration.

SCHOLARSHIP

Books:

2003 Fuel for Growth: Water and Arizona's Urban Environment. Tucson: University of Arizona Press.

Journal Articles:

1999 "Copper Chronicle: Magma Mine, Superior, Arizona," The Mining History Journal 6 (1999): 109-122.

1999 "Roadside Rest: From Stage Station to the Space Age in Gila Bend," Journal of Arizona History 40:4 (Winter, 1999): 345-376.

1998 "Ash Fork: Transportation and Town Building in Northern Arizona," Journal of Arizona History 39:2 (Summer, 1998): 155-174.

1996 "Taking a Bath: Civic Improvement in Clifton," Journal of Arizona History 37:3 (Autumn, 1996): 269-282.

1995 "Patagonia: Jewel of the Sonoita Valley," Journal of Arizona History 36:1 (Spring, 1995): 55-82.

1981 "Historic Preservation and Mass Transit Planning." American Society for Conservation Archaeology Report 8: (3): 8-19 (with Dale E. Hicks).

Dissertation:

1995 Urban Water in the Arid West: Municipal Water and Sewer Utilities in Phoenix, Arizona. Ph.D. dissertation, Arizona State University.

Thesis:

1986 Diversity Through Adversity: Tucson Basin Water Control Since 1854. Master's Thesis, University of Arizona, Tucson.

Book Reviews:

2001 Book Review of From Reclamation to Sustainability: Water, Agriculture, and the Environment in the American West by Lawrence J. MacDonnell, published in The Public Historian 23 (2): (Spring, 2001): 105-107.

2001 Book Review Essay "Investigating Urban Infrastructure," published in Journal of Urban History 27 (4): (May, 2001): 520-525.

1999 Book Review of Dividing New Mexico's Waters, 1700-1912 by John O. Baxter, published in Western Legal History 12 (1): (Winter / Spring, 1999): 105-107.

1996 Book Review of The Urban West: Managing Growth and Decline by James B. Weatherby and Stephanie L. Witt, published in Journal of Urban Affairs 18 (3): (Fall, 1996): 324-326.

1995 Book Review of Indian Water in the New West edited by Thomas R. McGuire, William B. Lord, and Mary G. Wallace, published in Journal of Arizona History 36: (Winter, 1995): 415-420.

1994 Book Review of Turning on Water with a Shovel: The Career of Elwood Mead, by James R. Kluger, published in Journal of Arizona History 35:2 (Summer, 1994): 219-220.

1994 Book review of Old Crosscut Canal, by Fred Anderson, published in The Public Historian 16:1 (Winter, 1994): 88-90.

1993 Book review of American Indian Water Rights and the Limits of Law, by Lloyd Burton, published in Western Legal History 6:2 (Summer/Fall, 1993): 235-236.

1992 Book review of Water Politics: Continuity and Change, by Helen Ingram, published in the Journal of Arizona History 33:1 (Spring, 1992): 110-112.

1991 Book review of Beyond the Wasatch: The History of Irrigation in the Uinta Basin and Upper Provo River Area of Utah, edited by Gregory D. Kendrick, published in The Public Historian 13:1 (Winter, 1991): 92-94.

Conference Papers and Public Talks:

2002 Lee's Ferry, Revisited. Paper presented at the Grand Canyon History Symposium, January 26, 2002.

2001 Arizona: Ripe for Land Fraud and Speculation? Paper presented at the Arizona Territorial Justice Forum, March 9, 2001.

2000 Trial on the Border: Ricardo Flores Magón and Arizona Territorial Justice. Paper presented at the Western History Association Annual Conference, October 13, 2000.

2000 Consulting in the Historical Profession. Paper presented to the Coordinating Committee for History in Arizona Workshop, February 25, 2000.

1999 A Day of Thanksgiving for Water, Revisited: Phoenix's First Water Celebration. Paper presented at Exhibit Opening, Arizona Historical Society Papago Park Museum, November 13, 1999.

1999 Water and Wastewater History, City of Phoenix. Paper presented to the Docent Training Seminar, Arizona Historical Society Museum, November 2, 1999.

1999 Engineering Marvels of the Jokake Inn. Paper presented to the Arizona Chapter of the American Public Works Association membership meeting, June 16, 1999.

1999 Ricardo Flores Magón: The Mexican Revolution on Trial in Tombstone, Arizona. Paper presented at the Arizona Territorial Justice Forum, May 7, 1999.

1999 Leadership in the Historical Profession: How to Become Your Own Leader. Talk presented to the Coordinating Committee for History in Arizona Workshop, February 19, 1999.

1998 How to Research Your Historic Home and Neighborhood. Talk presented to the Historic Preservation Workshop, City of Phoenix, June 27, 1998.

1998 Magma Mine: Preservation Challenges and Prospects. Talk presented to the 9th annual meeting of the Mining History Association, June 8, 1998.

1997 Mythic History: Culture and Ecology in Western Water Development. Invited paper presented to an international symposium titled "Water: Cultural Representations and Ecological Questions in Germany and the United States," University of Oregon, Eugene, October 16, 1997.

1997 Holbrook's Bucket of Blood Saloon: Violence and Vengeance in the West. Talk presented to the Scottsdale Corral of the Westerners, August 27, 1997.

1997 How Wild Was the Arizona Wild West? Talk presented to the Arizona Association for Life Long Learning, August 9, 1997.

1996 Taking a Bath: Civic Improvement in Clifton. Paper presented before the Arizona Historical Society Convention, April 27, 1996.

1994 Water and Wastewater History, City of Phoenix. Paper presented before the American Public Works Association Arizona Chapter Summer Workshop, July 25, 1994.

1994 Tempe's First Families: Soza, Sotelo and Elias. Paper presented before the Arizona Historical Society Convention, April 23, 1994.

1992 Convenience or Necessity? The Phoenix Sewer System, 1870-1912. Paper presented before the Arizona Historical Society Convention, April 30, 1992.

1991 Historical Research and Litigation in the Municipal Environment. Paper Presented at the 13th Annual Conference of the National Council of Public History, May 4, 1991.

1990 Search for Documentation: The Tucson Groundwater Experience. Paper Presented to the Water in the 20th Century West Symposium, March 31, 1990.

1989 The Drive for Municipal Ownership: Phoenix Water Works, 1898-1907. Paper Presented before the Arizona Historical Society Convention, March 21, 1989.

1987 Arizona Water History Archives Project. Prepared for University of Arizona Library, December 3, 1987.

1987 Persistent Perceptions: Ideology of Modern Water Use. Paper Presented before the Arizona Historical Society Convention, April 4, 1987.

1986 Mythology and Technology in Western Water Development. Paper Presented before the Phi Alpha Theta History Honor Society Meeting, May 5, 1986.

1985 University of Arizona Architectural Development. Paper Presented before the Arizona Historical Convention, May 3, 1985.

1985 University of Arizona National Register District Nomination Form (with Robert C. Giebner, David Blackburn, and Adelaide Elm).

1982 Plank Road Discontiguous District Nomination form (with Pat Welch and Lisa Capper).

1981 A Modern Material Culture study: South Carolina's Migrant Farmworkers. Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Exhibit 207

Ellen G. Endebrock

807 W. El Prado Rd. ▪ Chandler, AZ 85225
480/855-6725 (home) ▪ 602/495-5874 (work)
ellendebrock@earthlink.net

Education

New Mexico State University, Las Cruces, NM
- M.S. Civil Engineering (1990)

Northern Arizona University, Flagstaff, AZ
- B.S. Geology (1987)

Experience

City of Phoenix 07/2002–present
Hydrologist

Provided hydrologic, technical, and administrative expertise to the Law Department and city management regarding all aspects of the City's water rights, supply, and use

Maricopa County—Environmental Services Department 04/2001–07/2002
Senior Civil Engineer

Water/Wastewater Treatment Section: Reviewed and approved plans for reclaimed water irrigation systems and water treatment facilities; performed O&M inspections of water treatment plants; helped create standard reclaimed water user's manual (O&M manual for irrigation system owners); responded to citizen's complaints; support work for wastewater treatment plants and inspections

State of Arizona—Department of Water Resources 07/1998–04/2001
Water Resources Planner

Long-range water resources planning for rural areas: Coordinated with outside agencies to develop projects and policies for water resource management in rural areas; participated in and facilitated multi-agency committees and public outreach meetings; provided technical assistance in such areas as projecting future water demands, proposal review, grant writing, cost estimates, and report preparation

City of Los Angeles—Department of Water and Power 1990–1997
Assistant Civil Engineer

Aqueduct Operations and Engineering: designed aqueduct facilities and repairs; prepared construction and service contract specifications; managed service contract; inspected aqueduct facilities; prepared hazardous materials and safety reports; reviewed EISs, development plans, and plats for impacts to water supply and aqueduct facilities

Water System Infrastructure Planning: hydraulic analysis and operations modeling of water distribution system; conceptual design of water distribution facilities; prepared site layouts, grading and drainage plans, and cut and fill volumes; prepared cost estimates; headed team responsible for developing project scoping plan and documentation; assisted in preparation of 10-year Capital Improvement Plan

Groundwater Resources: designed and analyzed well tests and percolation tests; prepared groundwater development feasibility studies (including hydrogeologic evaluation, water quality analysis, environmental impacts, hydrologic budgets, economic analyses, final reports and recommendations) created and used groundwater, surface water balance, and operations models; created database of production and monitoring wells; coordinated ground water quality sampling schedule

Professional licenses

Registered Civil Engineer in Arizona (No. 32418) and California (No. C055517)

Computer and other skills

Microsoft Windows, Word, Excel, PowerPoint, Access; ArcView; AutoCAD; HTML; hydraulic/water distribution models

Continuing education workshops in Natural Stream Channel Design and Stream Channel Assessment

Exhibit 208

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NEPA Process
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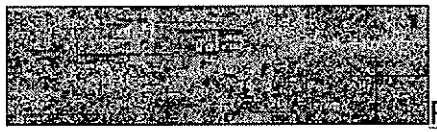
Other Projects and Studies: |Arizona Flood Warning|LCR|NE Phoenix|Rio de Flag|Rio Salado|Tres Rios|

Rio Salado


Rio Salado Aerial(1mg pdf file)

Agency Links

- Arizona Geological Survey
- Arizona Department of Water Resources
- Natural Resources Conservation Service
- Environmental Protection Agency
- The Flood Control District of Maricopa County
- Roughness Coefficients in Arizona Stream Channels
- USGS Arizona Water Resources
- Bureau of Reclamation
- Gila Monster; Interstate Watershed Management Program
- Verde River Watershed
- American Rivers

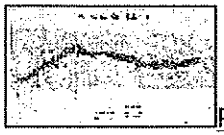
Overview

The time is at hand to fulfill the long-held dream of restoring the Salt River corridor, by implementing the Rio Salado Project. Just released by the U.S. Army Corps of Engineers is a draft Feasibility Report for construction of habitat restoration features in Phoenix and Tempe, Arizona. The study, upon final approval by the Corps, will be the basis of the request for federal authorization to build this first phase of the Rio Salado in Phoenix. The two cities are the nonfederal sponsors of the Corps' project and have partnered in creating the designs for construction of the Rio Salado. In Tempe, the project will be located in the Tempe portion of Indian Bend Wash and upstream and downstream from the Tempe Town Lake, now under construction, and in Phoenix, from the Interstate 10 bridge crossing of the Salt River, next to Sky Harbor Airport, west to 19th Avenue.


Tempe portion, Downstream (1 mg pdf file)


Tempe portion, Upstream (1 mg pdf file)

- Arizona Game and Fish
- More Water Resource Links


Phoenix portion (1 mg pdf file)

Even as a desolate scar, the Salt River continued to leave its mark through the valley during floods. In 1990, the Flood Control District of Maricopa County started a six-year project to control floodwaters and reduce damages in adjacent communities. The channelization also recovered over 800 acres of developable land in the floodplain, setting the stage for a future Rio Salado project. A unique opportunity arose in late 1993 when the administration decided that the mission of the Corps should be broadened to include restoration of areas that may have suffered damage by past Federal actions. This new mission for the Corps allowed Phoenix and Tempe to include consideration of water quality, recreation and habitat restoration in a request to study restoration needs in the Salt River.

The Corps had studied the Salt and Verde Rivers for years, but had never found the basis for a project based only on flood control criteria. Phoenix and Tempe were successful in requesting that Congress provide funding. A one year Reconnaissance Study was authorized to begin in early 1994. A reconnaissance study is conducted by the Corps to determine if there is sufficient federal interest in a project.

During the remainder of 1994, a study team, with representatives from Phoenix, Tempe, the Corps and the Maricopa County Flood Control District, formulated the concepts that became the basis for the Rio Salado Environmental Restoration Plan. Although the entire river through the metropolitan area was researched, the initial Rio Salado project was recommended to occupy a five-mile stretch of the river in central Phoenix and in three locations adjacent to Tempe's planned Town Lake. Rather than the original, extensive urban renewal oriented Rio Salado concept, this restoration theme would create desert riparian habitat, adapted for the highly altered physical conditions found in the river's channel as it

passes through the heart of the metropolitan area.

Essential features of the reconnaissance analysis were designing a project that would use available water and maintaining existing flood capacity. The study identified options for water supplies, using locally available sources, and designed the project to work in conjunction with the naturally occurring flood characteristics to create a flood management concept.

The Reconnaissance Report was completed in the spring of 1994. This plan, one of the first to respond to the new environmental restoration theme, was supported within the Corps organization. The effect of their approval was to authorize preparation of the next step, a Feasibility Study, in which the concepts would be detailed and analyzed to see if they could be actually applied to create this project. Because of a need to meet the federal water projects funding schedule, the timetable for the Feasibility Study was fast-tracked to complete the study in time to be submitted in the spring of 1998.

Steps to Construction

Rio Salado is currently one of the projects up for consideration in the 1998 Water Resources Development Act (WRDA). WRDA approval then officially authorizes the Rio Salado as a U.S. Army Corps of Engineers project. Funding for each year of construction still must be approved, but traditionally, the funds for construction of approved projects are included in the President's annual budget proposal to Congress. However, as the project will be built over several years, funding must be approved for each year of construction. With inclusion in the 1998 WRDA bill, the project could be started by the end of the year 2000, and completed sometime in the year 2003.

As a Corps project, the federal government will pay 65% of the project construction cost as well as financially participating for the first few years to ensure that it functions as planned.

The Rio Salado Plan

The Feasibility Report recommends two initial projects, a five mile portion of the river in Phoenix extending from the I- IO freeway bridge, near Sky Harbor Airport on the east, to 19th Avenue on the west. In Tempe, the project consists of three smaller areas adjacent to the upstream and downstream dams for Town Lake and on the lower end of Indian Bend Wash as it enters Town Lake.

The Phoenix project would be located entirely within the banks of the Salt River plus a 50 foot wide area on the top of each of the banks. No streets presently lie adjacent to the river, but several major bridges cross it at 24th Street, 16th Street, 7th Street, Central Avenue, 7th Avenue and 19th Avenue in addition to the 1-10 bridge. Elements of the project include:

- Flood management feature, a low flow channel constructed in the bottom of the present river, designed to pass the more frequent storm releases. The low flow channel including grade control structures to minimize the water's velocity during stormwater releases.
- Wells and a water delivery system that delivers water to the trees and other vegetation, wetlands, ponds and stream.
- Habitat elements including riparian tree species, volunteer riparian grasses and shrubs, wetlands, open water ponds, and a small flowing stream.
- Three public parking, access and project information facilities.
- Recreation and an interpretive trail system.

We will describe each of these features in more detail.

Description Of The Desert Riparian Habitat

The basis for the Rio Salado project falls under the Corps to restore altered or degraded ecosystems. In our area, the Salt River was the most

significant natural resource in this lower Sonoran Desert, and it was the basis for enabling human settlement in what would otherwise have been an inhospitable desert region.

Prior to dam construction in the early 1900's, the Salt River riparian vegetation was dominated by cottonwood, willow and the various species of mesquite trees. Mesquites occurred along the outer bank of the river and defined the outer edge of the natural riparian vegetation zone. Willow and cottonwoods were located inward of the mesquites, adjacent to the river bottom and closer to where there was a more continuous flow of water. Some channel areas were barren, while others had vegetation in strips along the river bottom and in abandoned high flow channels.

The historic bottom lands of the Salt River valley supported a variety of vegetation, including trees, shrubs, marsh plants and some grasses. Beyond the cottonwoods and willows, grew alders on the margins of the river and Palo Verde. Sagebrush joined the mesquite on the low riverside terraces. Vegetation grew so densely in some places it was impossible to cross the bottom lands, while in other locations vegetation was open and more scattered. There were several species of fish in the river's waters, similar to those found in the lower Gila River.

The lower Salt River was originally a perennial stream, fed by the snowmelt from the mountains to the east and highlands to the northeast. Its clear, streaming waters contrasted with the muddy, sluggish waters of the Gila River. Flows in the river had a distinct seasonal pattern, with the highest flows occurring in December and January and the lowest in October. The river had many channel meanders, sand bars and backwater areas that were conducive to riparian plant and wildlife growth.

The Phoenix Rio Salado project will re-create the low flow channel and a first terrace within the existing outer banks of a five-mile long channelized portion of the river through central Phoenix. Previously occurring vegetative habitat will be incorporated and a water supply system built to

support the habitat. The total area of the five-mile long project will be about 550 acres.

In Tempe, the planning objectives are to restore riparian habitat; bringing the area to a more natural condition through the installation of plant species that are native to, and occurring historically in riparian streams and washes in the region; identify water supplies which will sustain riparian habitat in restored areas; increase passive recreation opportunities incidental to the restoration; contribute to other qualitative environmental objectives. The Tempe project would be located within the banks of the Salt River channel and in Indian Bend Wash. The street boundaries of the area include McClintock Road at the east, Priest Drive at the west, Rio Salado Parkway on the south and McKellips Drive on the north. Elements of the project include:

- Braided streams and small ponds, possibly lined to contain water within the habitat areas.
- Water delivery system for the streams and irrigation.
- Habitat elements including riparian tree species, planted native grasses and shrubs, wetlands with aquatic vegetation, bosque tree and shrub species removed from the direct water path.
- One public parking area with other parking provided by nearby development, project information and interpretive signage, kiosks, ramadas and picnic facilities.
- Recreational interpretive trail system for wildlife watching, plant identification, habitat monitoring and field trips.
- The Tempe project will not contain a low flow channel or terrace. The habitat will be designed withing the existing channel, extending from levee to levee. Native vegetation will be planted along constructed streams and ponds. The total area of the three sections is 140 acres.

Project Schedule

The Corps and the local sponsors continue to work on refining the design

of the proposed project. Construction of a Federal project awaits congressional authorization with the passage of a Water Resources Development Act and the associated appropriation of funds. Search for other Planning projects...

Related Links:

- RioSalado.com
- Tempe Town Lake on the Rio Salado
- Constructed Wetlands: Using Human Ingenuity, Natural Processes to Treat Water, Build Habitat by Joe Gelt
- Fish and Wildlife: Division of Habitat Conservation National Wetlands Inventory
- EPA, Office of Water, Wetlands
- WES Environmental Laboratory, Wetlands
- USGS: Ecology of Plant and Animal Species in Western Riparian and Wetland Systems
- USGS: National Wetlands Research Center
- Wetlands in danger

Other Projects and Studies: |Arizona Flood Warning|LCR|NE Phoenix|Rio de Flag|Rio Salado|Tres Rios|

| Planning Mission | Planning Projects | National Environmental Policy Act and the Corps |
| Planning Process | Become a sponsor in a Civil Works Project | Contact us | Arizona Home |
Page last updated August 12, 1999 (STJ)

Exhibit 209

[Title Page and Verso]

Up: Contents *Previous:* Frontispiece *Next:* List of illustrations

History

of

Arizona

by

THOMAS EDWIN FARISH,

Arizona Historian.

Volume VI.

Phoenix, Arizona,

1918.

The Filmer Brothers Electrotype Company

Exhibit 210

APPLIED RIVER MORPHOLOGY

DAVE ROSGEN
Wildland Hydrology
Pagosa Springs, Colorado

Illustrations
HILTON LEE SILVEY
Western Hydrology
Lakewood, Colorado

the meander geometry of the river where the riffle/pool sequence or spacing is on the average one-half a meander wavelength or approximately 5-7 bankfull channel widths. The primary morphological features of the "C" stream type are the sinuous, low relief channel, the well developed floodplains built by the river, and characteristic "point bars" within the active channel. The channel aggradation/degradation and lateral extension processes, notably active in "C" stream types, are inherently dependent on the natural stability of streambanks, the existing upstream watershed conditions and flow and sediment regime. Channels of the "C" stream type can be significantly altered and rapidly de-stabilized when the effects of imposed changes in bank stability, watershed condition, or flow regime are combined to cause an exceedance of a channel stability threshold. "C" stream types may be observed in valley types IV, V, VI, VIII, IX and X. They can also be found on the lower slope positions of the very low gradient valley type III.

The "D" Stream Type

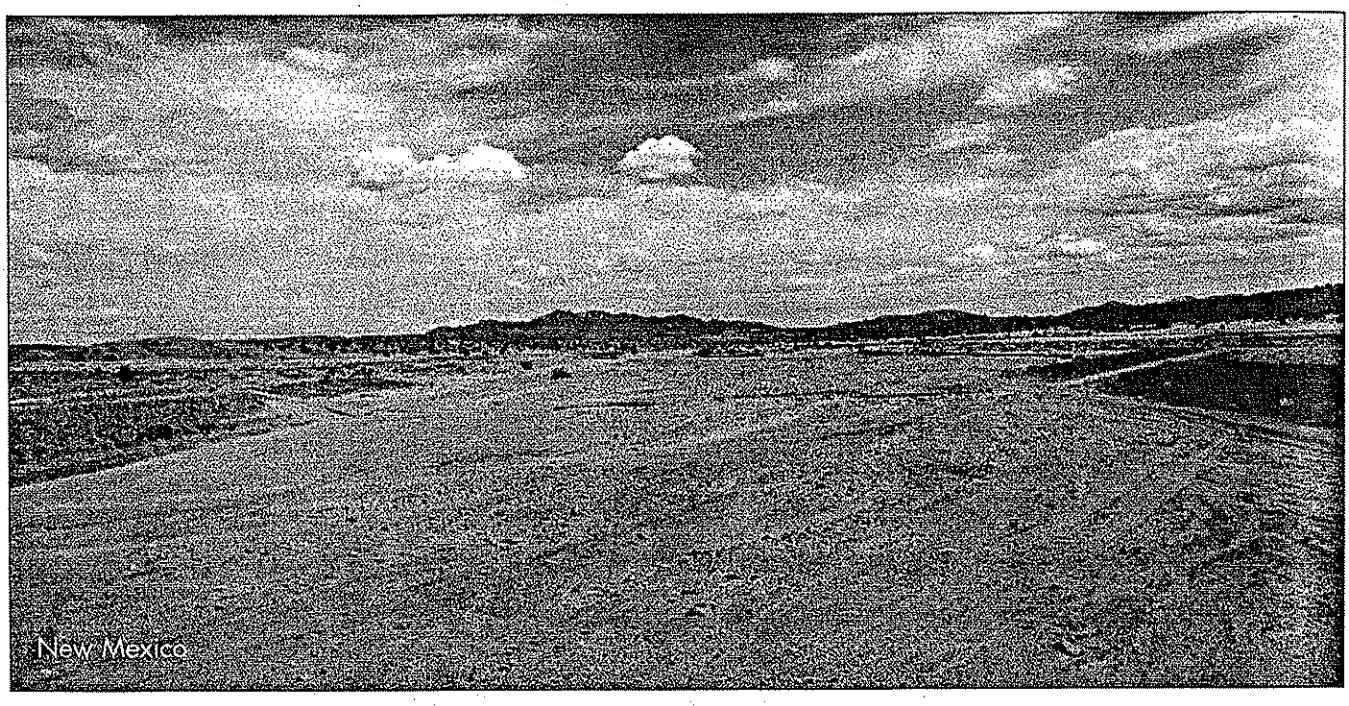
The "D" stream type is uniquely configured as a multiple channel system exhibiting a braided, or bar-braided pattern with a very high channel width/depth ratio, and a channel slope generally the same as the attendant valley slope. "D" type stream channels are found in landforms and related valley types consisting of steep depositional fans, steep glacial trough valleys, glacial outwash valleys, broad alluvial mountain valleys, and deltas. While the very wide and shallow "D" stream types are not deeply incised, they can be laterally contained in narrower or confined valleys. Bank erosion rates are characteristically high and meander width ratios are very low (***Figure 4-4***). Sediment supply is generally unlimited and bed features are the result of a convergence/divergence process of local bed scour and sediment deposition. The multiple channel features are displayed as a series of various bar types and unvegetated islands that shift position frequently during runoff events. Adjustments in channel patterns can be initiated with either natural or imposed changes in the conditions of the encompassing landform, contributing watershed area, or the existing channel system. Aggradation and lateral extension are dominant channel adjustment processes occurring within a range of landscapes from desert to glacial outwash plains. Typically, the runoff regime is "flashy," especially in arid landscapes with highly variable extremes of stage occurring on an annual basis which generates a very high sediment supply. Braided channel patterns can be found developing in very coarse materials located in valleys with moderately steep slopes, to very wide, flat, low gradient valleys containing finer materials. The "D" stream type may develop within valley types III, V, VIII, IX, X, and XI.

The "DA" (Anastomosed) Stream Type

The "DA" or anastomosed stream type is a multiple-thread channel system with a very low stream gradient and the bankfull width of each individual channel noted as highly variable. Stream banks are often constructed with fine grained cohesive bank materials, supporting dense-rooted vegetation species, and are extremely stable. Channel slopes are very gentle, commonly found to be at or less than .0001 (Smith, 1986). Lateral migration rates of the individual channels are very low except for infrequent avulsion. Relative to the "D" stream type, the "DA" stream type is considered as a stable system composed of multiple channels. Channel width/depth ratios and sinuosities may vary from very low to very high. The related valley morphology is seen as a series of broad, gently sloping wetland features developed on or within lacustrine deposits, river deltas or splays, and fine-grained alluvial deposits. The "DA" stream types make up a very small number of observed stream types, but are unique both in the process of their creation and maintenance. In certain locations operating at a "control" point within a valley, maintains the valley base level where a vertical balance exists between the rate of deposition and the rate of uplift (Smith and Putnam, 1980). The geologic processes responsible for development of the anastomosed river include subsidence of sedimentary basins in tectonically active forelands, valley base level rise at the

MORPHOLOGICAL DESCRIPTION AND EXAMPLES OF STREAM TYPES

D5 Stream Type



The D5 stream types are multiple channel systems described as braided streams, found within broad alluvial valleys and on alluvial fans consisting of deposited sand-sized materials. The braided system consists of interconnected distributary channels formed in depositional environments. The D5 stream type occurs in gentle gradient, narrow, U-shaped glacial valleys consisting of glacio-lacustrine deposits, sand dunes (eolian); in very low relief alluvial valleys; and in glacial outwash areas and deltas. The D5 stream channels may be found in Valley Types III, V, VIII, IX, X, and XI. Channel bed materials are predominantly sand, with interspersed amounts of silt/clay materials on deltas and in varves of lacustrine depositional areas. The braided channel system is characterized by high bank erosion rates, excessive deposition occurring as both longitudinal and transverse bars, and annual shifts of the bed location. Bed morphology is characterized by a closely spaced series of rapids and scour pools formed by convergence/divergence processes that are very unstable. The channels generally are of the same gradient as their parent valley. A combination of adverse conditions are responsible for channel braiding, including high sediment supply, high bank erodibility, moderately steep gradients, and very flashy runoff conditions which can vary rapidly from a base flow to an over-bank flow on a frequent basis. Characteristic width/depth ratios are very high, exceeding values of 40 to 50 with values of 400 or larger often noted. D5 channel gradients are generally less than 2%; however, D5 types can also develop within alluvial fans which have slopes of 2% to 4% (D5b). Observations have been made of braided streams on alluvial fans with slopes greater than 4% (D5a). The D5 is a very high sediment supply system, and typically produces high bedload sediment yields.

Exhibit 211

IN THE

SUPREME COURT

OF THE

STATE of ARIZONA

C. RODNEY MacDONALD,
Appellant,

vs.

W. H. PERRY, E. P. PERRY and OTHELLA L. PERRY, and CITY OF PHOENIX, a Municipal Corporation,
Appellees.

No. 2571

ABSTRACT OF RECORD.

KIBBEY, BENNETT, GUST, SMITH AND LYMAN,
Attorneys for Appellant.

Filed this 29 day of Nov, 1926

Eugenia Davis
Clerk of the Supreme Court.

INDEX—Continued

Question. Which direction from your farm?

Answer. I can show you where this water, when I am not using it, which is a very small 193
portion of the time, when crops are in shape so they don't require water, I turn it out this waste-way, and I will show you where. Right here at this point where my ditch crosses the road into Section 21 I have a long flume there and I have a ditch running North to that point there that irrigates this land West. The ditch goes South and carries on down in this direction to irrigate all this land lying in here in Section 21. I have some land also down here that I irrigate, and in order to get to that, 194
I had to put in a spill-way here under the flume to turn the water South and take it out again in here. I have a ditch there I built when I first took this land over. The waste water from all these farms North and East of me used to come down this section known as Lateral 16, and there's a low place in here below the Lower Buckeye Road, which was always a bog hole. As a matter of fact, I can't get down in here horse-back without bogging 195
my horse. So I had to construct a lateral from this point; the Water Users had a ditch down to that point and they turned the water loose and it remained on the section line and spread down over this land here, which I now own since 1912, and that whole country there was

a bog hole from this waste water off this project and a jack-rabbit couldn't get in there. I have been bogged down there with a saddle horse. I couldn't get in. So I constructed a
196 lateral down this section line to the old bed of the river. Not the present channel, but the old bed of the river, which turns West through my own property and come into the main channel of the river, still on my own land in Section 21, about the center of the section. This ditch that I dug down there for the purpose of taking care of that waste water, I afterwards used this portion of it from this flume down to this point to run my water in and irrigate
197 this lower land here which I leveled, and when I am not using this water it goes on down this old lateral I built into this channel and goes West to the main channel of the river.

The course the water has now is just a narrow stream.

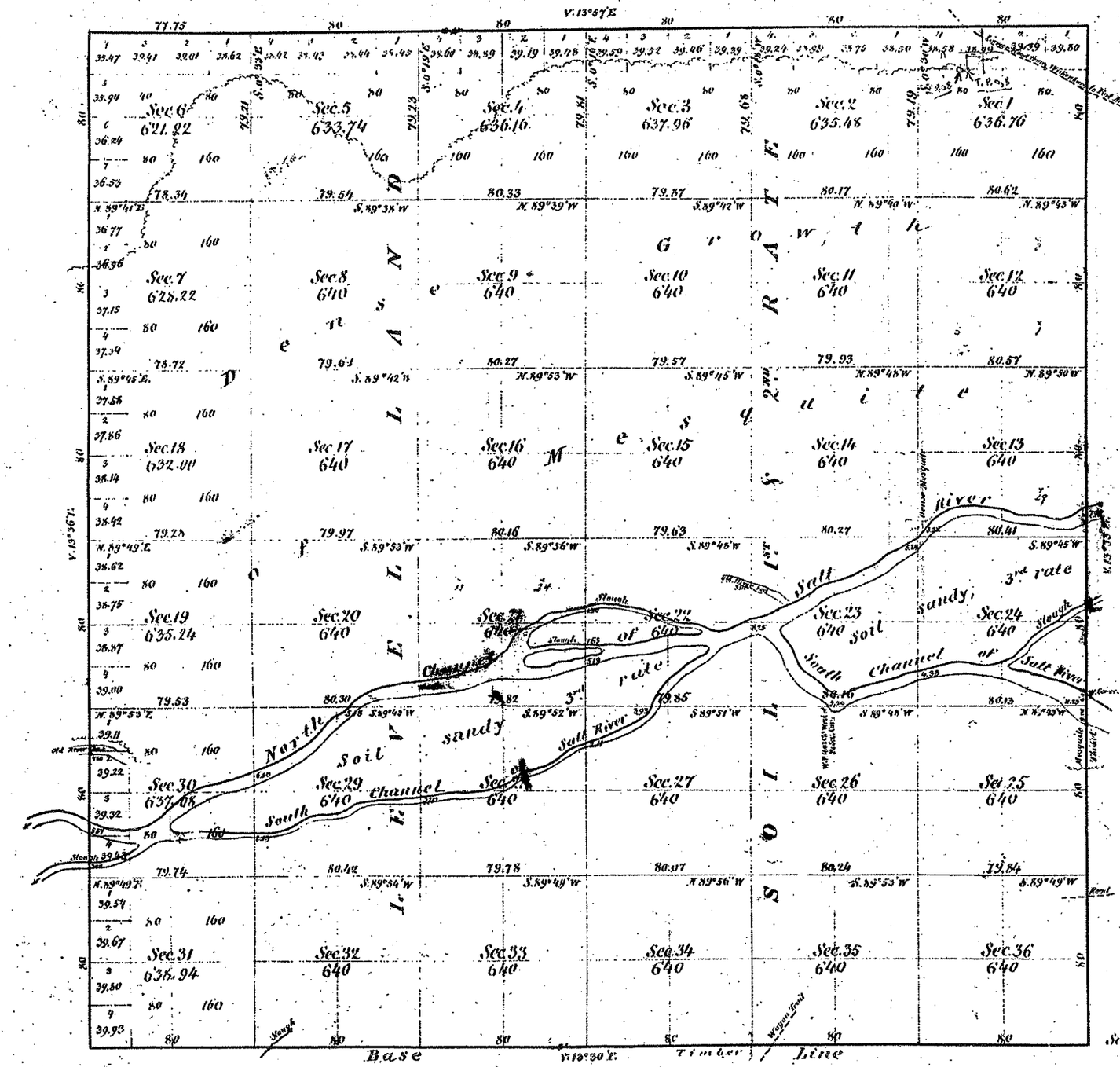
RE-DIRECT EXAMINATION

BY MR. GUST.

The point where I turn loose that waste
198 water is a mile West and half a mile South of Mr. Perry's home. It is approximately a mile and a half or a little less than that on a straight line. It is about a mile and an eighth on a straight line from my own home.

Exhibit 212

Township No. 1 North. Range No. 2 East, Gila and Salt River Meridian



Received and Filed in U.S. Land Office Prescott Arizona December 2nd 1870.

Register

Aggregate Area of Public land 22,972.80 Acres.

Section lines run at a Variation of 13° 33' East.

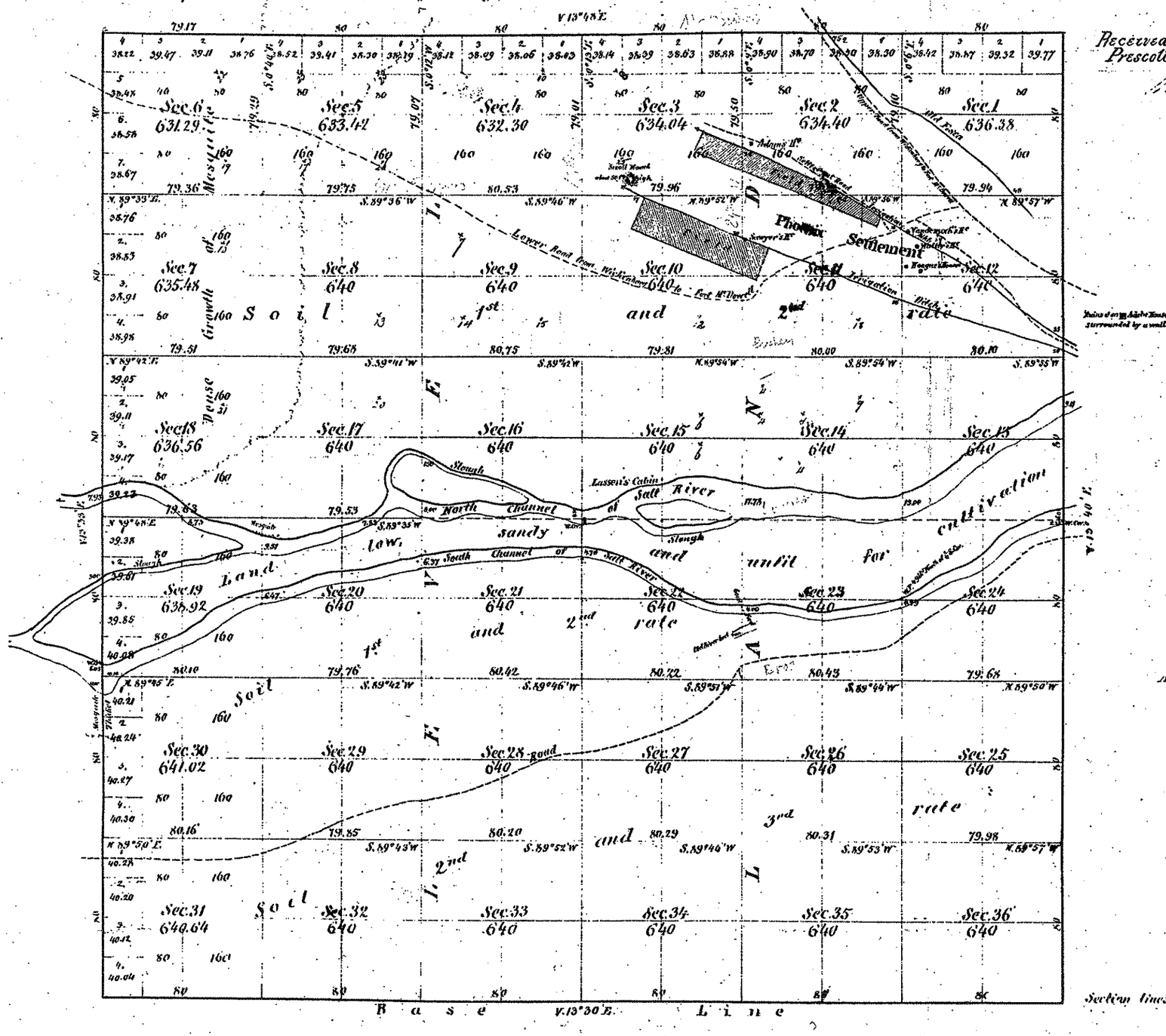
Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
South boundary of Township	Wm H. Pierce	December 15th 1866		1867.
Rest of Township lines	W. L. Ingalls	February 18th 1868	17 Mls. 77 Chs. 75 Lks.	1868
Section lines	" " "	" " "	59 . 74 . 26 .	March 24th 1868.

The above Plats of Township No. 1 North, Range No. 2 East of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this office which have been examined and approved.

Surveyor General's Office,
San Francisco, California,
October 9th 1868.

Sherman

Township No. 1 North, Range No. 3 East, Gila and Salt River Meridian



Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
South boundary of Township	Wm. H. Pierce	December 15th 1866	...	1867
West of Township lines	W. F. Ingalls	February 15th 1868.	17 M. 79 Ch. 17 L.	1868
Section lines	" " "	" " "	55 " 75 " 82 "	April 4th 1868.

Received and filed in U.S. Land Office
Prescott, Arizona, December 2nd 1870.
[illegible]
Register.

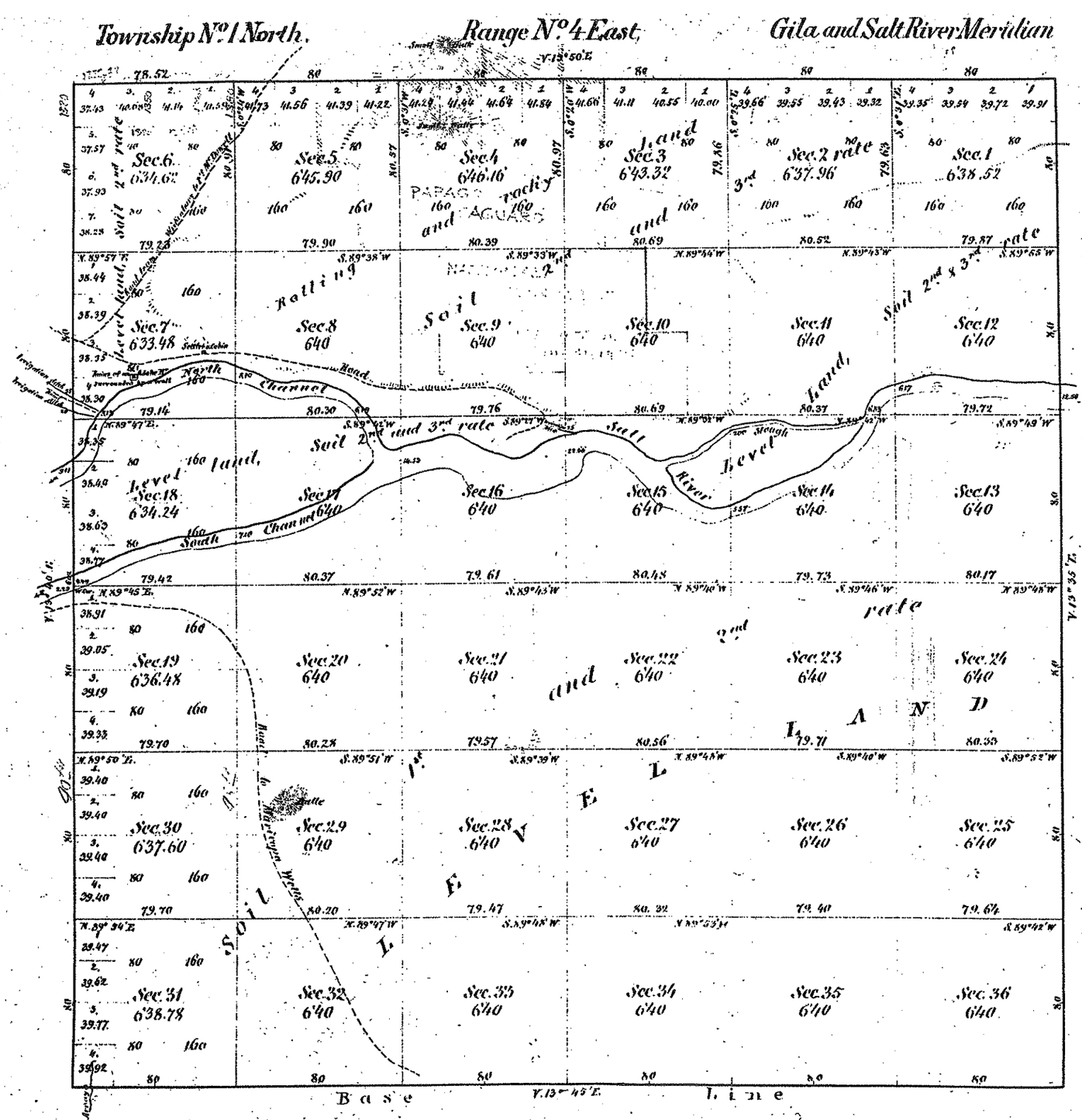
Aggregate Area of Public land 22,997.89 Acres.

Section lines run at a Variation of 13° 40' East

The above Map of Township No. 1 North, Range No. 3 East of Gila and Salt Riv
is strictly conformable to the field notes of the Surveys thereof on file in this Of
been examined and approved.
Surveyor General's Office,
San Francisco, California,
October 15th 1868.

[illegible]

Township No. 1 North, Range No. 4 East, Gila and Salt River Meridian



Received and filed in U.S. Land Office
Prescott Arizona December 2nd 1870.
[illegible] Register.

Aggregate Area of Public Land 23,027.06 Acres.

Section lines run at a Variation of 13° 35' East.

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
South boundary of Township	Wm. H. Pierce	December 15th 1866		1867.
Rest of Township lines	W. F. Ingalls	February 18th 1868	17 M. 78 Ch. 52 Lks.	1868
Section lines	" " "	" " "	60 " 01 " 18 "	April 16th 1868.

The above Map of Township No. 1 North, Range No. 4 East of Gila and Salt River Meridian — is strictly conformable to the Field notes of the Surveys thereof on file in this Office, which have been examined and approved.

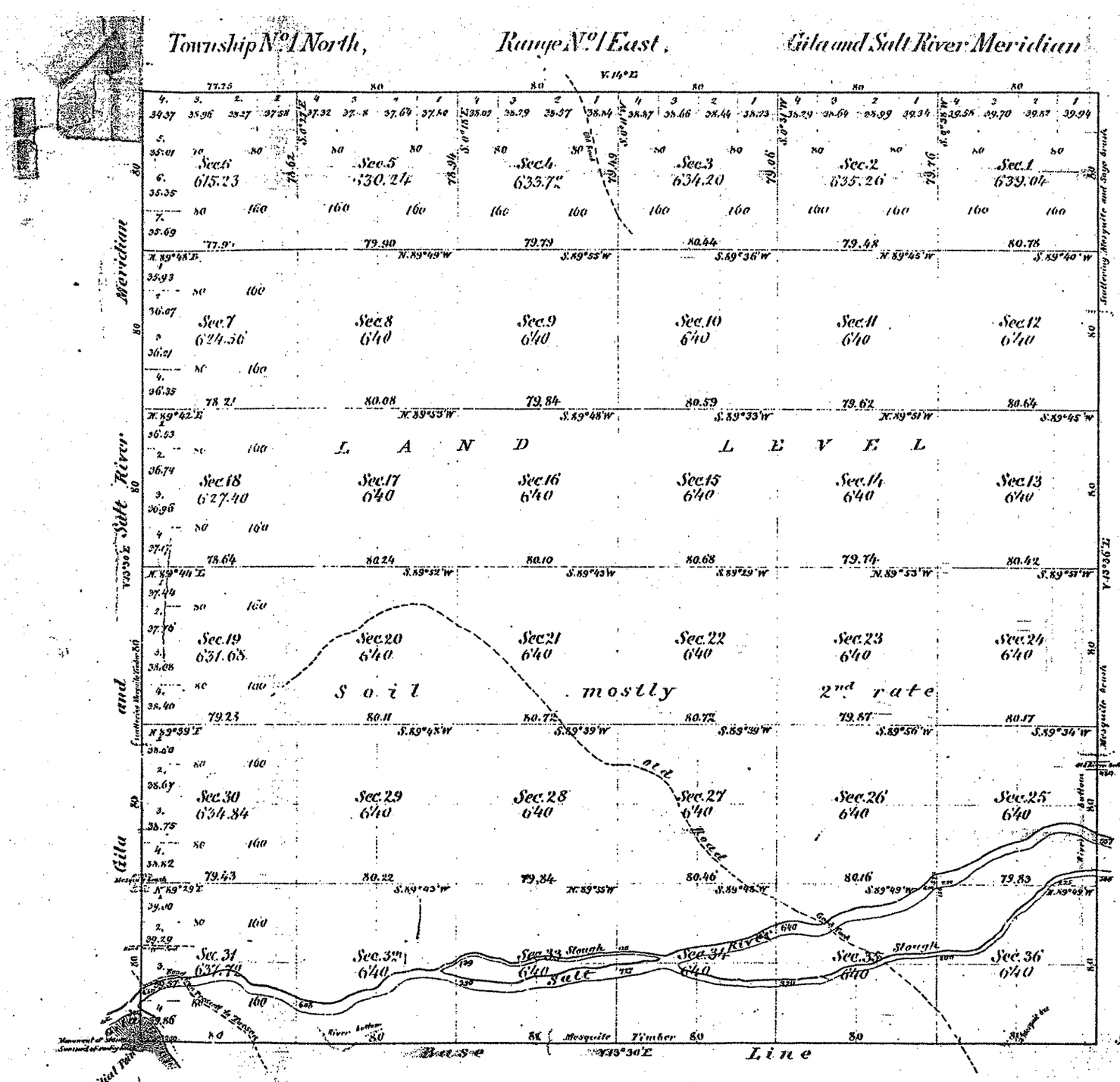
Surveyor General's Office,
San Francisco, California,
October 21st 1868.

Township No. 1 North, Range No. 1 East, Gila and Salt River Meridian

00004

Received and filed in U.S. Land Office
Prescott Arizona December 2nd 1870.
W. F. Ingalls
Register.

OFFICIALLY FILED 12-2-1870



Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
West and South boundary of Township	Wm H Pierce	December 15th 1868		1867
East & North " "	W. F. Ingalls	February 18th 1868	11 Mls 77 Chs 25 Lks	1868
Section lines " "	" " "	" " "	59 . 73 . 80 .	March 12th 1868.

Aggregate Area of Public land 22,944.89 Acres

Section lines run at a Variation of 13° 36' East.

The above Map of Township No. 1 North, Range No. 1 East of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this Office which have been examined and approved.
Surveyor General's Office,
San Francisco, California,
October 8th 1868.

Surveyor General

Exhibit 213

ST. JOHNS

CANAL

INDIAN CANAL

GILA AND SALT

RIVER

INITIAL MONUMENT

B.M. 1066

B.M. 1053

RANGE 1 EAST

17'30"

112°15

12'30"

1904

Exhibit 214

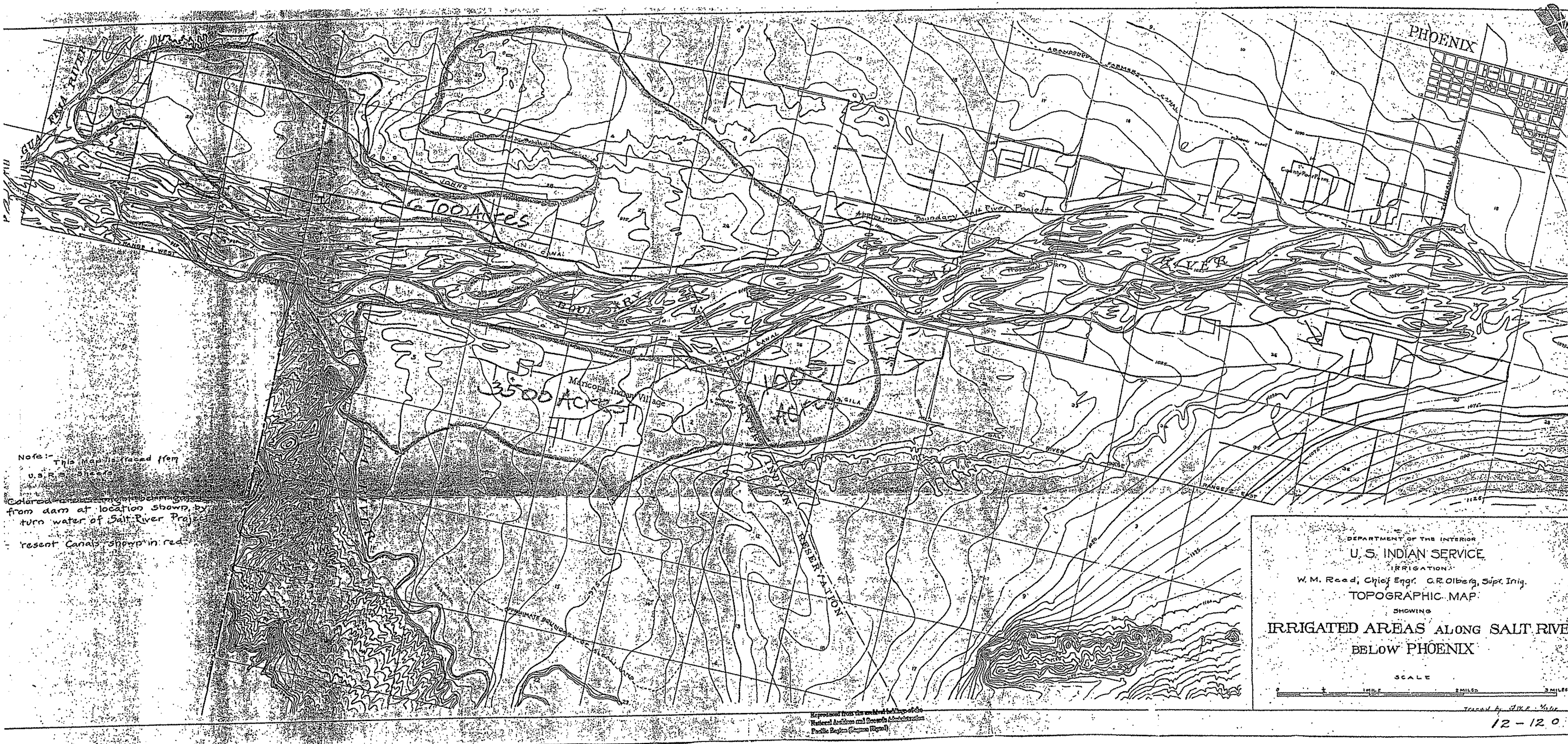

PHOENIX
GILA RIVER
Approximate Boundary Salt River Project
Proposed Dam
RIVER
Maricopa Indian Village
6700 Acres
3500 Acres
INDIAN RESERVATION
SALT RIVER
RANGE 2 EAST
Note:- This Map is traced from U.S.R.S. Sheets
Colored areas might be irrigated from dam at location shown by turn water of Salt River Project
Present Canals shown in red
DEPARTMENT OF THE INTERIOR
U. S. INDIAN SERVICE
IRRIGATION
W. M. Reed, Chief Engr. C.R. Olberg, Supt. Irrig.
TOPOGRAPHIC MAP
SHOWING
IRRIGATED AREAS ALONG SALT RIVER
BELOW PHOENIX
SCALE
0
1 MILE
2 MILES
3 MILES
12-120

Exhibit 215

Salt River Daily Flow, 1904 - 1909