



Hassayampa River Post-Flood Study Final Report

June 17, 2005

Prepared For:
Flood Control District of Maricopa County
FCD 2002030



Prepared By:



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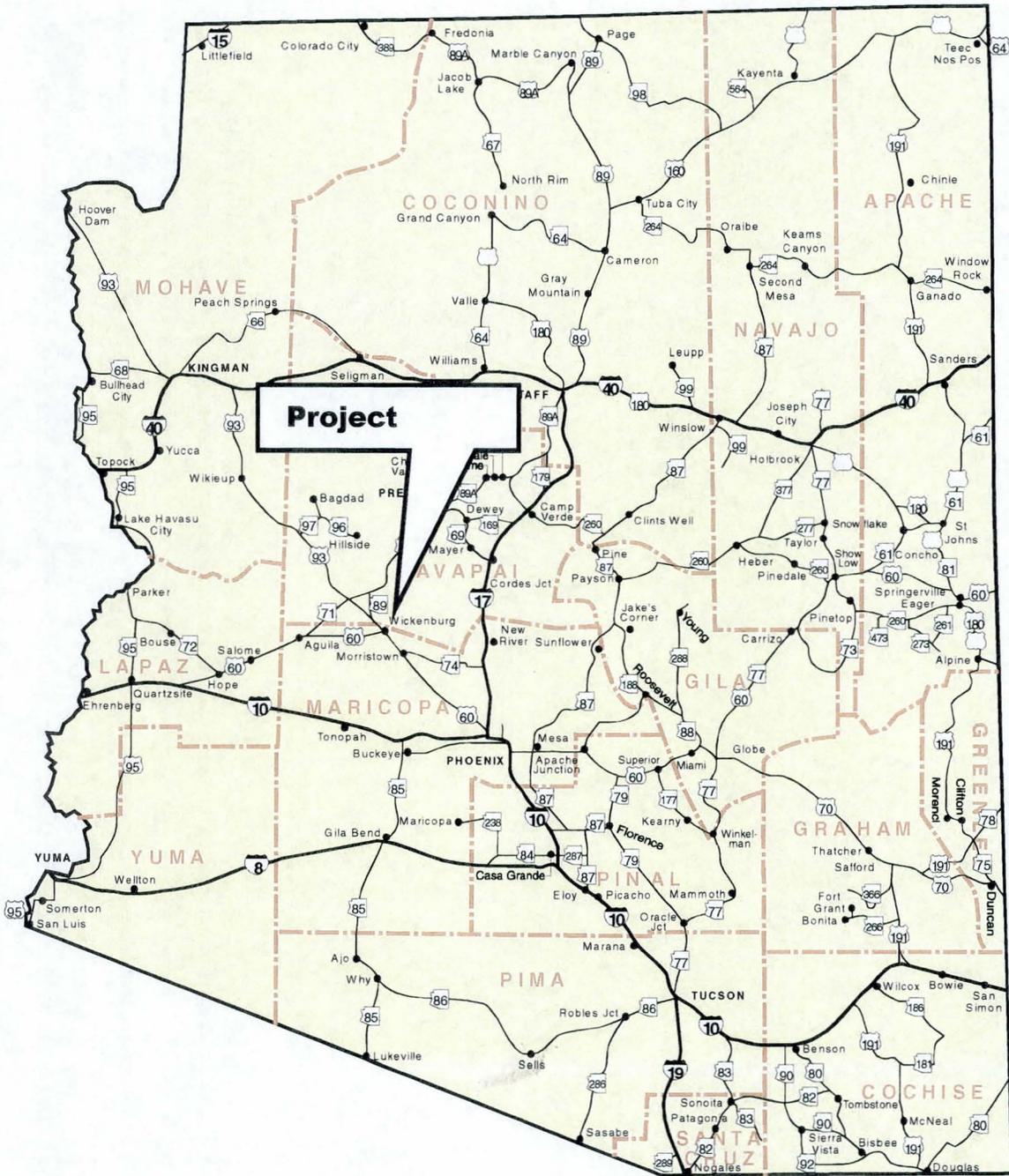
1 EXECUTIVE SUMMARY

AZTEC was retained by the Flood Control District of Maricopa County (District) to perform a post-flood documentation report for flooding that occurred in the Hassayampa River on February 12th & 13th, 2005. This visual report includes all available data collected documenting the recent flooding and the changes in the project limits in recent history. It also describes post-flood repair measures by others taken to mitigate flood damage.

The primary study reach is the Hassayampa River and its banks and overbanks from about one-half mile north of the existing US 60/93 Bridge to approximately one mile south of the US 60/93 Bridge. The project limits can be further described as being parts of Sections 1 and 12 of Township 7 North (T&N), Range 5 West (R5W) and Section 7 of T7N, R4W of the Gila and Salt River Baseline and Meridian, Maricopa County, Arizona. The Project Location Map is shown on Figure 1. An aerial view of the primary study reach is shown in Figure 2. The project limits also include two areas outside of the primary study reach; the first area is the east bank of the Hassayampa River three miles downstream of the US 60/93 Bridge at the Horspitality RV Park. The second area is also along the east bank of the Hassayampa River adjacent to the US 60, approximately seven miles downstream of the US 60/93 Bridge.

The purpose of this report is to document the extents and results of the flooding, show the changes in the watercourse over recent history, and document the post-flood mitigation efforts. This report is intended to be a factual documentation of historic events.

FIGURE 1 – Project Location Map



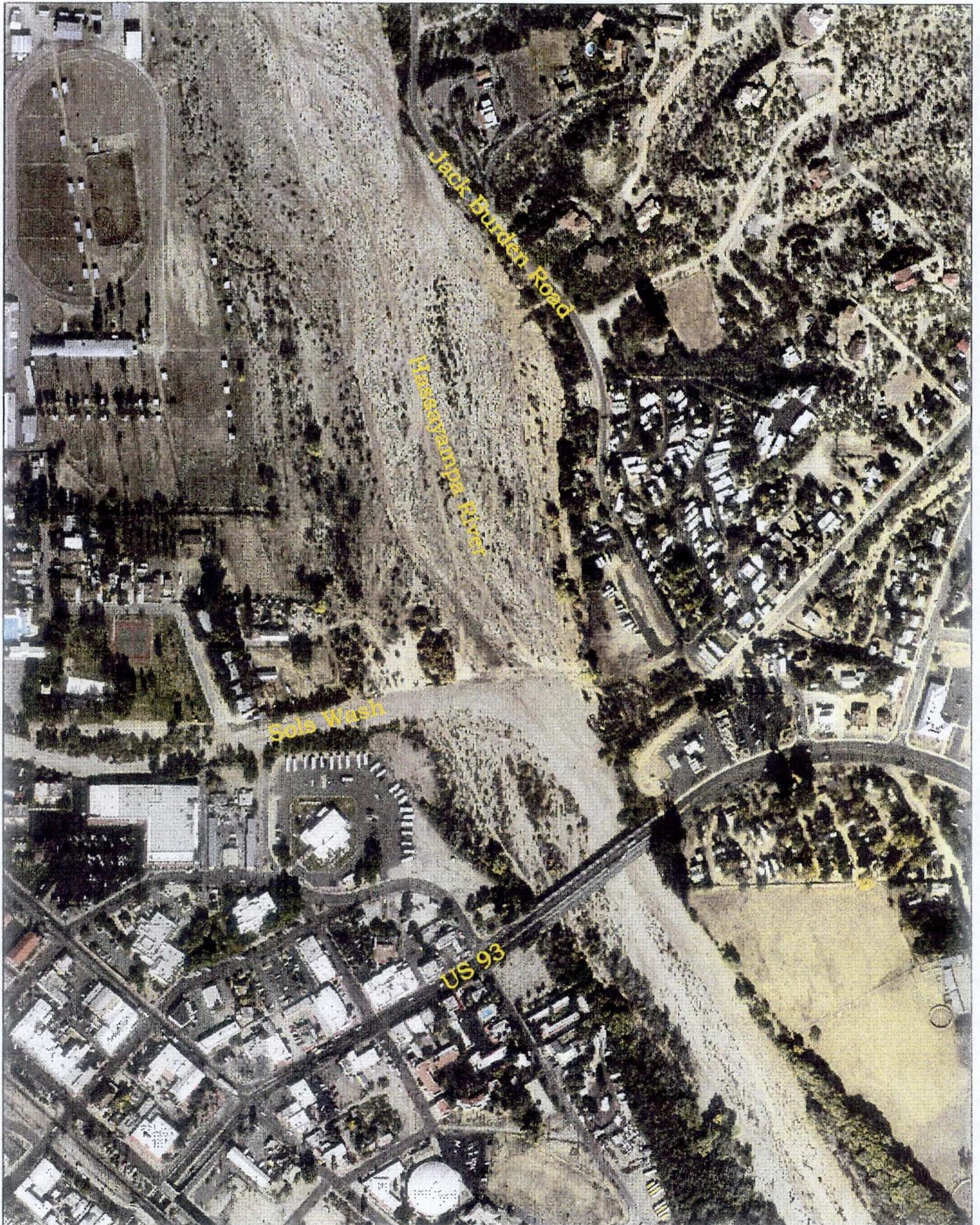
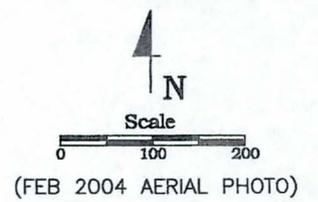


FIGURE 2 - AERIAL MAP



2 INTRODUCTION

2.1 Project Purpose

The purpose of this report is to present the data that was collected for the flood damage, changes in the watercourse over recent history, and the amounts and costs of the post-flood mitigation. The flow in the Hassayampa River on February 12th & 13th, 2005 was not a major event, but it caused significant flood damages. The data presented in this report represents pre- and post-flood conditions as well as recent historic conditions.

2.2 Project Need

A watercourse master plan (WCMP) is planned for this portion of the Hassayampa River in the future. The changes in the river described in this drainage report will aid in the recommended design alternatives for the master plan. This drainage report will also recommend areas requiring further study.

2.3 Flood Damages

The flooding that occurred during the weekend of February 12 and 13, 2005 destroyed two homes, a trailer, a shed, and two cars (see Figure 3). The flood also destroyed a portion of Jack Burden Road, the waterline in the road and a power line along the road. Two homes had significant damage due to the flood, but were able to be repaired. According to a letter from the Town of Wickenburg to the Arizona Department of Emergency Management, the damage was estimated as approximately \$2.4 million. A copy of this letter has been included in Appendix A1.

The following is an excerpt from a February 28, 2005 memo from Dennis Cvancara of Maricopa County Emergency Management to Steve Sipple of the National Weather Service:

... The next major storm to strike Maricopa County occurred on Thursday, February 10th, when a powerful storm moved in again from the west. The National Weather Service, in anticipation of heavy runoff as warm rains melt(ed) snow in the high country, issued flash-flood watches and urban and small-stream flood warnings. The town of Wickenburg received 1.89 inches of rain swelling the Hassayampa River. The river washed away two mobile homes and two vehicles. Additionally, the Jack Burden Road was washed out and three utility poles were lost, resulting in power outages. Arizona Public Service reported 25 individuals were left without power which was restored the following Monday. Telephone, water and gas service was also restored that day. The Maricopa County Sheriff's Office was credited with rescuing 21 individuals in 11 incidents during the weekend ending February 13th as helicopter crews plucked individuals from vehicles stranded in various washes...



EAST BANK
DESTROYED BY
THE FLOOD

RAY JOHN'S
RESIDENCE

SOLE WASH

SOLE WASH
SEDIMENT
DEPOSIT
(FROM 2000
STORM EVENT)

JACK BURDEN RD

CONSTITUTION RD

US 80



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 3
FLOOD DAMAGE
(FEBRUARY 2004 AERIAL PHOTO)

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

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FLOOD CONTROL DISTRICT
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 FIGURE 3
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Photo 1: Residence on eastern bank of the Hassayampa River looking north just upstream of the US 60/ 93 Bridge. (February, 2005)



Residence
in Photo 1

Photo 2: Aerial view along the eastern bank of the Hassayampa River just upstream of the US 60/93 Bridge courtesy of Flying M Air Photos. (February 2005)

3 HASSAYAMPA RIVER

3.1 Pre-Flood Condition

Sols Wash flows frequently flows independently from the Hassayampa River. This type of independent flow event occurred October 21, 2000. The District's stream gage 7043 located in Sols Wash approximately one mile west of Vulture Mine Road indicated a peak flow of 10,800 cfs for that event. A great deal of sediment was transported in that flow event, much of which settled at the southern portion of the confluence to the Hassayampa River. Two digital topographic maps were collected as part of this study; the first map was created in 2000 just prior to the Sols Wash flood event. The second topographic map was created in 2004 as part of the US 93 bypass project for ADOT. A comparison between these two topographic maps shows the west portion of the Hassayampa aggraded up to four feet after the October 2000 Sols Wash flow event (See Figure 4).

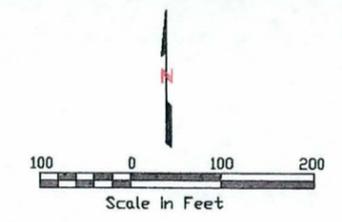
3.2 Post-Flood Condition

The flooding of February 2005 left a large quantity of debris and sediment within the watercourse.



Photo 3: Automobile in the river near the eastern bank of the Hassayampa River just upstream of the US 60/93 Bridge. (April 2005)

The sediment deposit from the October 2000 flood in Sols Wash was almost entirely removed by the flood. The larger flows in the Hassayampa removed this sediment and deposited it along the watercourse as the flows were reduced. The following photograph (Photo 4) shows the western bank of the Hassayampa River, the previous river invert and the current river invert.



- LEGEND:**
- 2004 ADOT TOPO
1 FOOT CONTOUR
INTERVALS
(CONVERTED TO
NAVD88)
 - 2000 FLOOD
CONTROL TOPO
2 FOOT CONTOUR
INTERVALS
(NAVD88)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

HASSAYAMPA POST-FLOOD STUDY
FIGURE 4
TOPO COMPARISON
(FEBRUARY 2004 AERIAL PHOTO)

	BY	DATE
DESIGNED	PAW	.6/05
DRAWN	KRL	.6/05
CHECKED	TAB	.6/05

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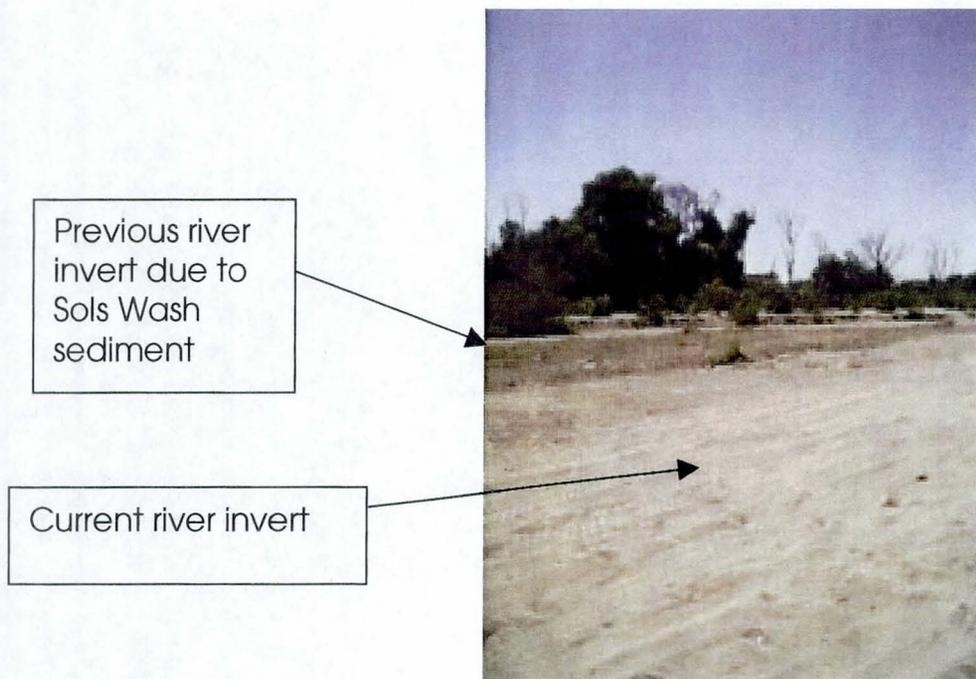
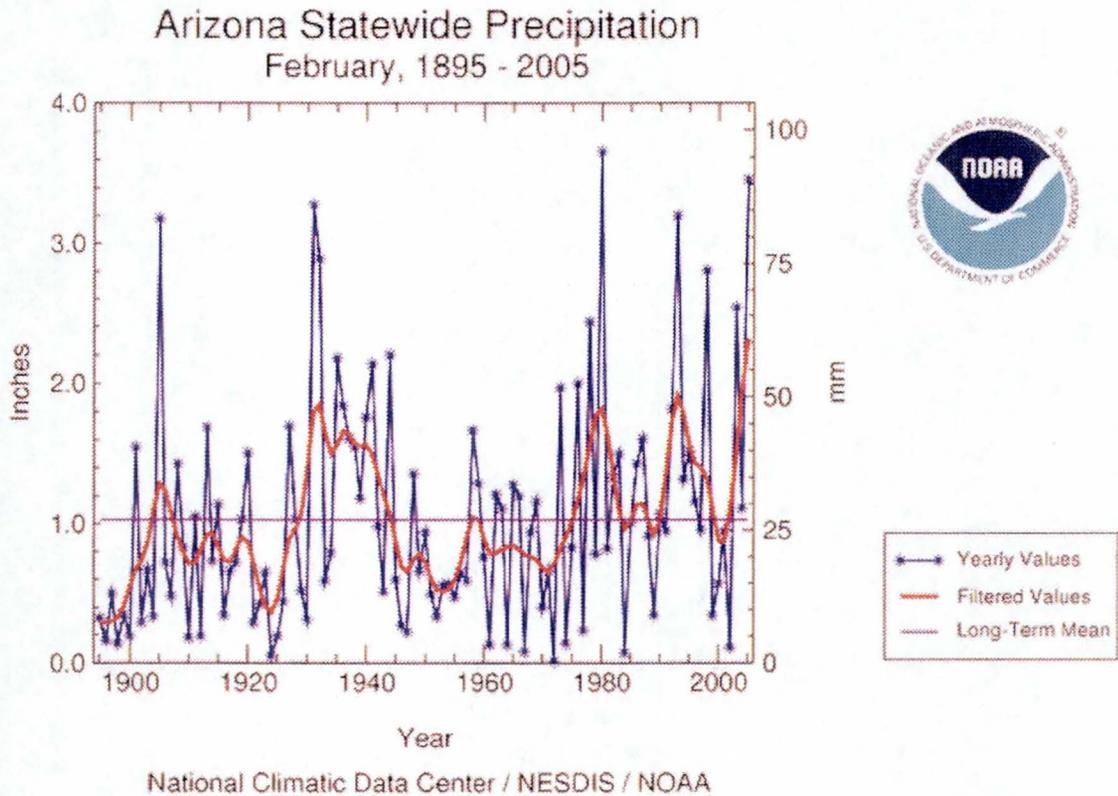


Photo 4: View along the western bank of the Hassayampa River just downstream of the confluence with Sols Wash. (June, 2005)

3.3 Precipitation

The District prepared a Storm Report for the February flooding; a copy of that report is included in Appendix A.2. That report shows that the precipitation for the month of February 2005 can be broken into three distinct storm periods. First, a minor storm brushed the northern parts of the County on Feb. 6th and 7th. The heaviest storm drenched central Arizona on the 10th through the 12th. Finally, a procession of storms affected the entire State from the 17th through the 24th, with slight breaks on the 21st and 22nd. Most ALERT stations recorded rainfall on at least 10 of the 28 days in February – many of the northern stations recorded rainfall on 14 or more days. Figure 5 below shows that, for all of Arizona, 2005 is second only to 1980 as the wettest February since records have been kept.

FIGURE 5



3.4 Gage History for the River

The drainage area of the Hassayampa River at the US 60/93 Bridge is 711 square miles according to the 2001 FEMA Study (Reference 2). The nearest upstream tributaries with basins of significant size are Sols Wash, located about 750 feet upstream of the US 60/93 Bridge over the Hassayampa, and Martinez Wash, located about 2 ½ miles upstream of the US 60/93 Bridge. Both of these washes are on the west side of the Hassayampa. Sols Wash at the confluence with the Hassayampa has a drainage area of 147.2 square miles according to the Maricopa County FIS (Reference 3), while the Yavapai County FIS shows that Martinez Wash has a drainage area of 103 square miles (Reference 4).

In recent years, the District has maintained pressure transducer gages on the Hassayampa River at Box Canyon, at the US-60, and near Morristown. These gages record stage levels every few minutes during flood events; these stages are converted to flow rates using a rating curve. These gage records are included in Appendix A.3. The Box Canyon gage has been in place since October 1991. The peak flow of record for that gage is 15,451 cfs on 2/20/1993, which is midway

between the 5-year and 10-year recurrence interval. The US-60 gage has been in place since March 1994. The peak flow of record for this gage is 15,376 cfs on 9/26/1997, which is less than the 20-year recurrence interval. The Morristown gage has been in place since May 1996. The peak flow of record from the FCD for this gage is 9,095 cfs on 9/26/1997 and corresponds to the 5-year recurrence interval. The February 2005 flows for the Hassayampa River are addressed in the following section.

3.5 Hydrology/Hydraulics

The current regulatory (FEMA) 100-year estimated flow rate for the Hassayampa River at Wickenburg is 71,000 cfs, with a drainage area of 711 square miles (Reference 2). The current FEMA Flood Insurance Rate Map is included in Appendix A.4. The 10-year, 50-year, and 500-year floods are not published in the current flood insurance study (FIS). However, these floods appear in a previous FIS (Reference 3). The published values in the previous study are provided in Table 1.

Table 1: Hassayampa River Floods From July 1977 FEMA Wickenburg FIS (Revised 1983).

Location	Drainage Area (sq. miles)	10-year flood	50-year flood	100-year flood	500-year flood
0.32 miles (approximately) upstream from Wickenburg corporate limits	564	14,500	47,000	71,000	185,000
0.14 miles (approximately) downstream from Wickenburg corporate limits	671	14,000	46,000	70,000	184,000

West Consultants created a duplicate effective hydraulic model as part of their US 93 Bypass Report (Reference 5). This model used 71,000 cfs at the US 60/93 Bridge. A copy of this drainage report is included in Appendix A.5.

According to the District's Storm report (Reference 1), flows in the Hassayampa River peaked during the late morning of February 12, 2005. The District's gage 5223 in the Hassayampa River at Morristown recorded a peak flow of 14,962 cfs, which is slightly larger than the 10-year event.

3.6 Aggradation/Degradation in River

As discussed in Section 3.2, Figure 4 shows the aggradation along the western bank due to the October 2000 Sols Wash flood. It also shows the western portion of the Hassayampa River at the US 60/93 Bridge has aggraded over the last four years.

ADOT conducts periodic field inspections of its bridges. During these inspections, measurements are taken from the low chord of the bridge to the ground. West Consultants analyzed the ADOT data in their US 93 Bypass Report. This information illustrates the change in cross section over the years. Aztec measured this distance as part of the data collection effort to compare the post-flood cross section to the previous measurements. The comparison of the cross section is included in Figure 6.

3.7 Sols Wash Sediment Transport

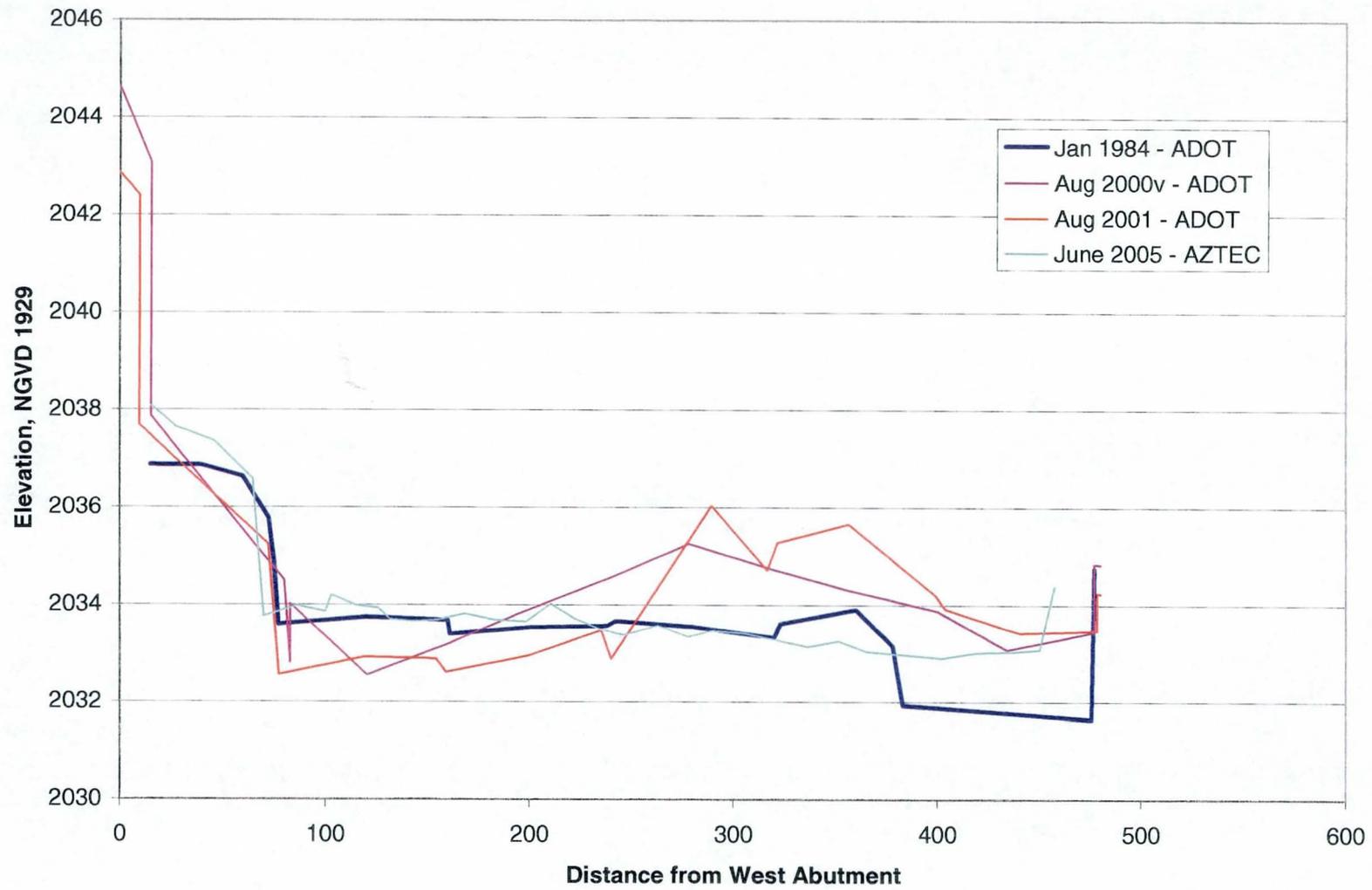
According to the scour analysis prepared by the Sols Wash Candidate Assessment Report (Reference 6), Sols Wash is degrading in its upstream segment. It conveys a large amount of sediment towards the confluence with the Hassayampa River, as shown in Photo 5. Additionally, the confluence of Sols Wash is nearly perpendicular to the Hassayampa River, which causes flow in Sols Wash to slow as it transitions into the Hassayampa River. This causes the sediment in the wash to settle with this portion of the wash aggrading, as shown in Figure 4.

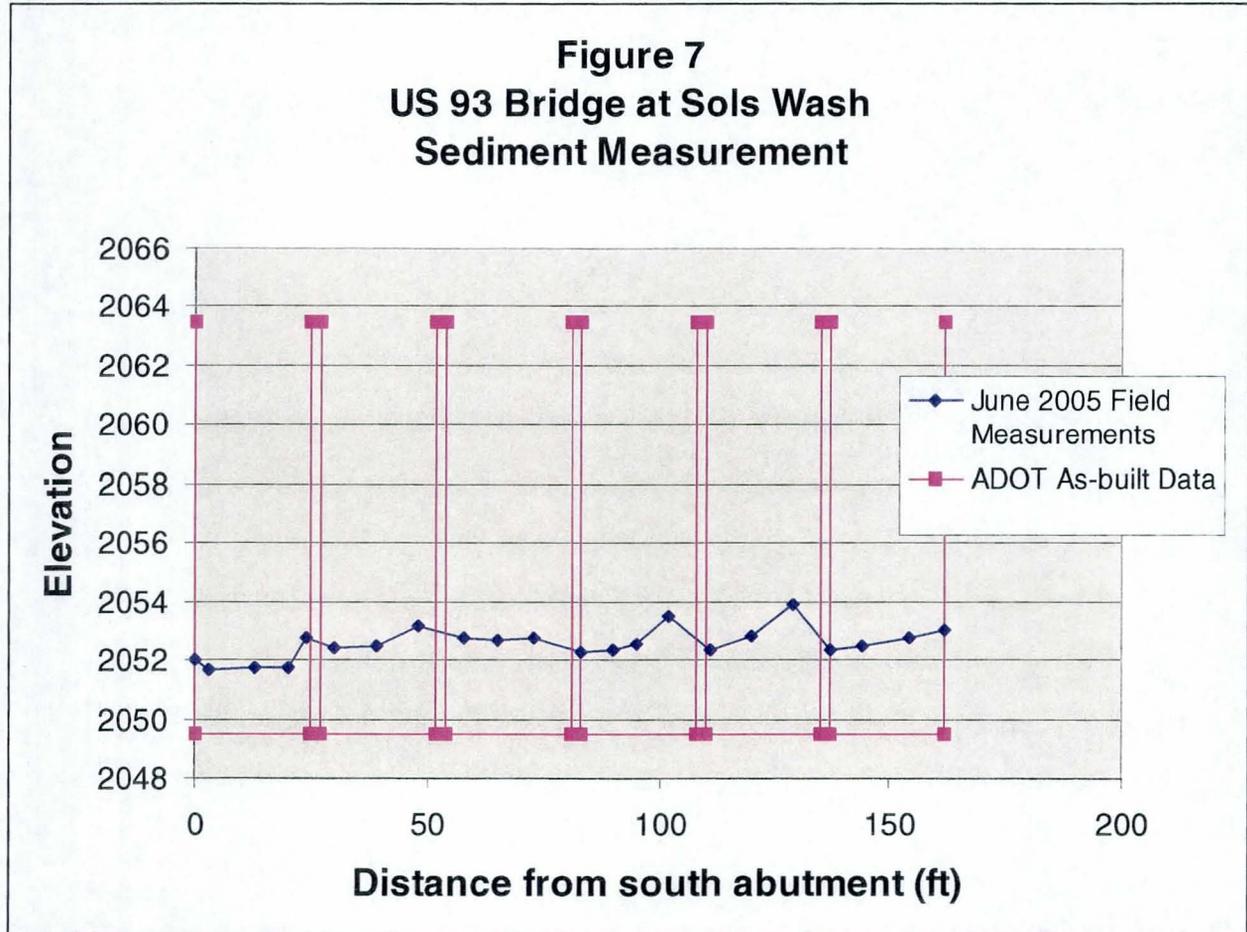


Photo 5: The brown sediment laden flow at the downstream side of existing US 93 Bridge over Sols Wash looking north. (October 2000)

Recent field measurements indicate that Sols Wash has aggraded from 2 ½ to 4-feet at the US 93 Bridge. Figure 7 shows the amount of sediment that has accumulated in Sols Wash at the US 93 Bridge since construction.

Figure 6
Historical Cross Sections Based on ADOT measurements - Westbound US-60 Bridge





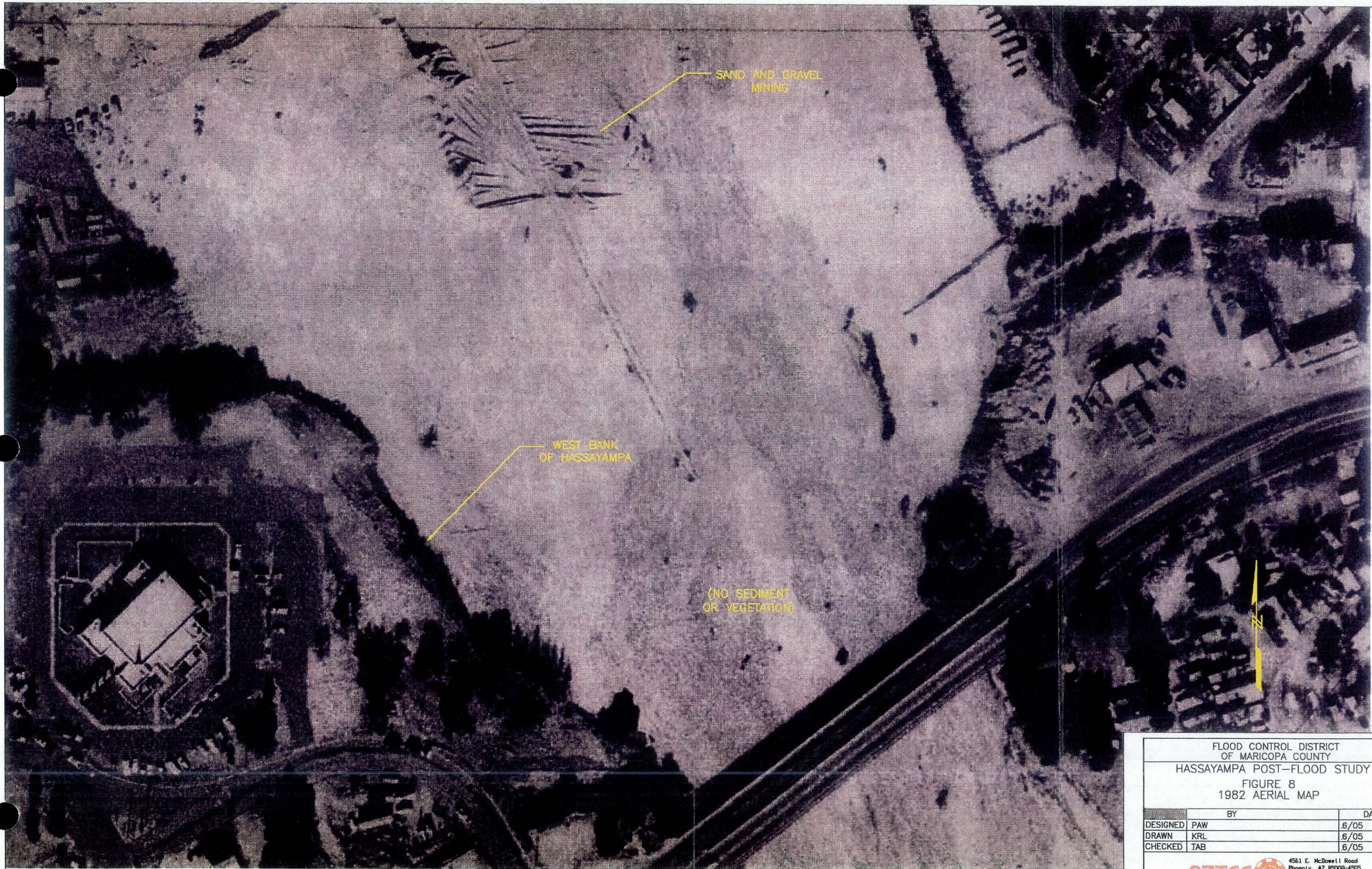
3.8 Lateral Migration in River

West Consultants delineated the thalweg for the Hassayampa River as part of their US 93 Bypass Report using 1971 and 2003 topography. The comparison between the thalwegs, as shown on Figure 3.2 included in Appendix A.5, demonstrates the thalweg has shifted as much as 200 to 300 feet in some reaches, but in other reaches, it is nearly unchanged. Under the US 60/93 Bridge, the thalweg has shifted to the east.

3.9 Watercourse Changes

The US 93 Bypass Report concluded that the Hassayampa River has degraded slightly since 1971. The degradation is more pronounced in the east overbank area of the channel. This report also deduced that Sols Wash has been aggrading in the downstream reach since 1971. Figure 6 shows that Sols Wash deposited a few feet of sediment along the western portion of the Hassayampa River after the October 2000 flood event. The sediment appears to have constricted the river, moving the low-flow conveyance to the east.

Ready Mix Concrete, Inc. used to mine the sediment at the confluence of Sols Wash and the Hassayampa River. This mining operation stopped over 15 years ago. The effect that this sand and gravel operation on the sediment deposits left from Sols Wash is evident in the 1982 aerial photograph (Figure 8). The operation was located just upstream of the confluence of Sols Wash and the Hassayampa River and mined the sediment in the watercourse.



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 8
1982 AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

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4 POST-FLOOD MITIGATION

4.1 Mitigation Projects

4.1.1 Jack Burden Road

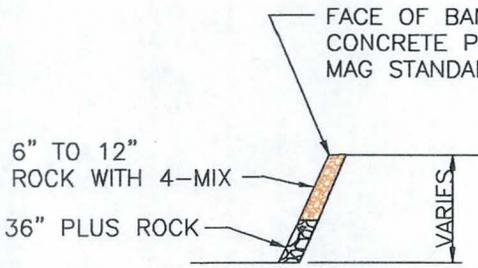
The Town of Wickenburg filed for an Emergency 404 permit from the U.S. Army Corps of Engineers (COE) on Tuesday, February 15, 2005. A copy of the request and the reply from COE are included in Appendix A1. The Town contracted with several construction companies to construct bank protection along the east bank of the Hassayampa from the US 60/93 Bridge northwest one-half mile. This construction included repairing Jack Burden Road, the waterline, and the power line. The construction costs to date are approximately \$1.1 million. The construction costs and a list of subcontractors used by Wickenburg are included in Appendix A1. The following table shows the amounts of materials used to construct the bank protection.

TABLE 2
Quantities of Material for Post-Flood Mitigation
Town of Wickenburg

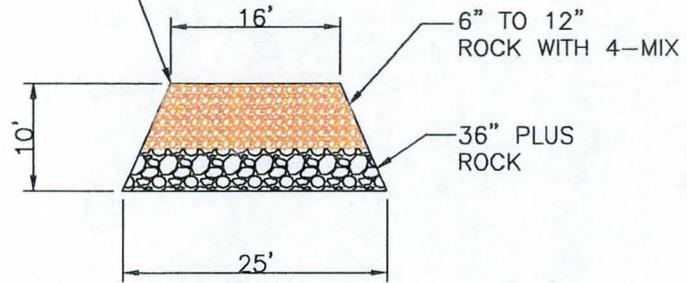
Material	Amounts
ABC	6,915 tons
Rip Rap, 6 to 12 inches	19,525 tons
Boulders, Kilauea	7,485 tons
Pit Run/ Screen Fill	3,000 tons
Boulders, Custom	765 tons
Concrete Rip Rap	22 tons
57 Rock/ Septic Rock	480 tons
6.5 Sack Grout	80 yds
Lumber, Shoring	1 LS
Cattle Guard	1 Ea
Guard Rail	Lf
Replacement of Hitching Posts	Ls
Staging Area Asphalt Replacement	Ls

A detail of the bank protection and levy constructed on the east bank and its limits are shown in Figure 9.

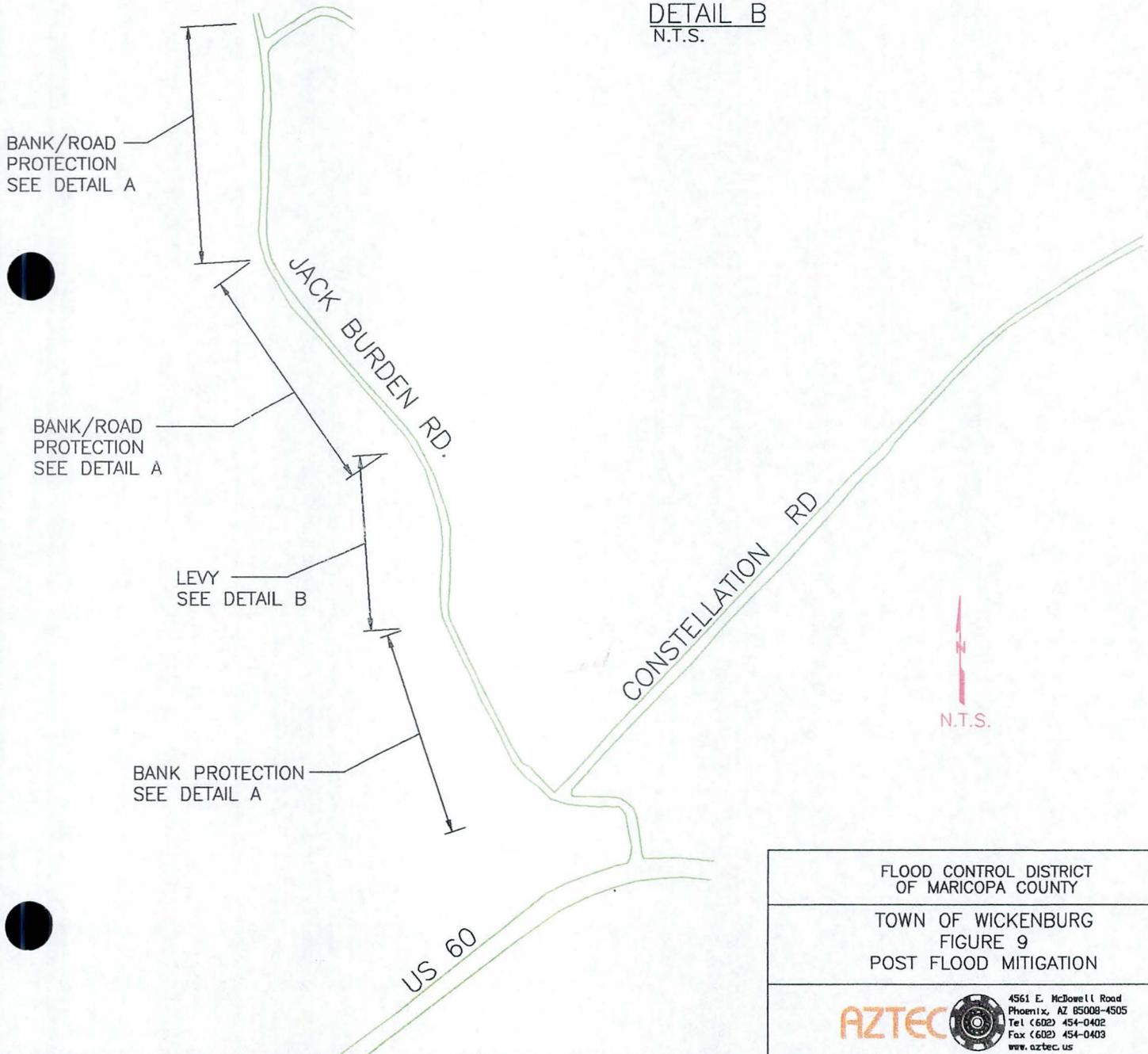
FACE OF LEVY
TO BE COVERED W/
SAME BANK PROTECTION
DETAIL A W/LAYER OF
7 SACK GROUT BETWEEN
LEVY AND BANK PROTECTION



DETAIL A
N.T.S.



DETAIL B
N.T.S.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TOWN OF WICKENBURG FIGURE 9 POST FLOOD MITIGATION
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4.1.2 Horspitality RV Park

The Horspitality Trailer Park filed for an emergency nationwide permit 13 with the COE on February 13, 2005. This permit is for bank protection and is required for bank stabilization greater than 500 linear feet for all waters of the U.S. The Horspitality Trailer Park hired a subcontractor to construct a temporary dike to protect their property. The subcontractor used dredged river material along with uprooted vegetation and debris for stabilization. According to the Horspitality RV Park, the temporary dike cost \$6,000 to construct.

The trailer park is working with the National Resources Conservation Service (NRCS) in designing and constructing permanent bank protection along the damaged area. The Horspitality RV Park said they received two bids for the permanent bank construction. The first bid estimate was \$54,000 and included 300 liner feet of bank protection. The second bid estimate was \$27,000, but involved far less construction. The NRCS is required to approve funding for this project. If funding is approved, it is anticipated that the permanent bank protection will be constructed within one year and the temporary dike removed.



*Photo 6: Along the temporary dike for the Horspitality Trailer Park.
(April 2005)*

4.1.3 US 60

ADOT mitigated the area damaged along the US 60 by dumping large soil cemented boulders along the bank. They filled the area behind the new bank protection with ABC and constructed a barrier fence.



*Photo 7: The bank protection along US 60 constructed by ADOT.
(April 2005)*

4.2 Qualitative Assessment of Improvements

4.2.1 Jack Burden Road

The bank protection along the east bank of the Hassayampa for the Town of Wickenburg did not account for scour. The bank protection was constructed while the river was still flowing, so toe-down protection was not constructed. Visual inspection shows that the eastern portion of the Hassayampa River is degrading and could eventually undermine this bank protection. The base of the bank protection is 25-feet wide and is constructed of 3-foot minimum size rip-rap. This base may be wide that it can sustain scour along its base, further analysis will need to be performed on the bank protection. Due to the hasty nature of procurement and placement, it is doubtful that the rip-rap is well graded.

4.2.2 Horspitality RV Park

The temporary dike constructed by the Horspitality RV Park is not an engineered structure. Any flow event of consequence could damage or breach this temporary dike. There is no other protection for the trailer park should the temporary dike fail.

4.2.3 US 60

The bank stabilization constructed by ADOT consisted of dumping “soil-cement” dirt boulders (see Section 6.2) along the eastern bank of the river. This construction did not account for scour along the bank and therefore toe-down protection was not provided. The boulders are very large in diameter, but are not durable stone and easily broken apart. This bank protection does not provide permanent remedy, only temporary protection.

4.3 Projections of Improvements

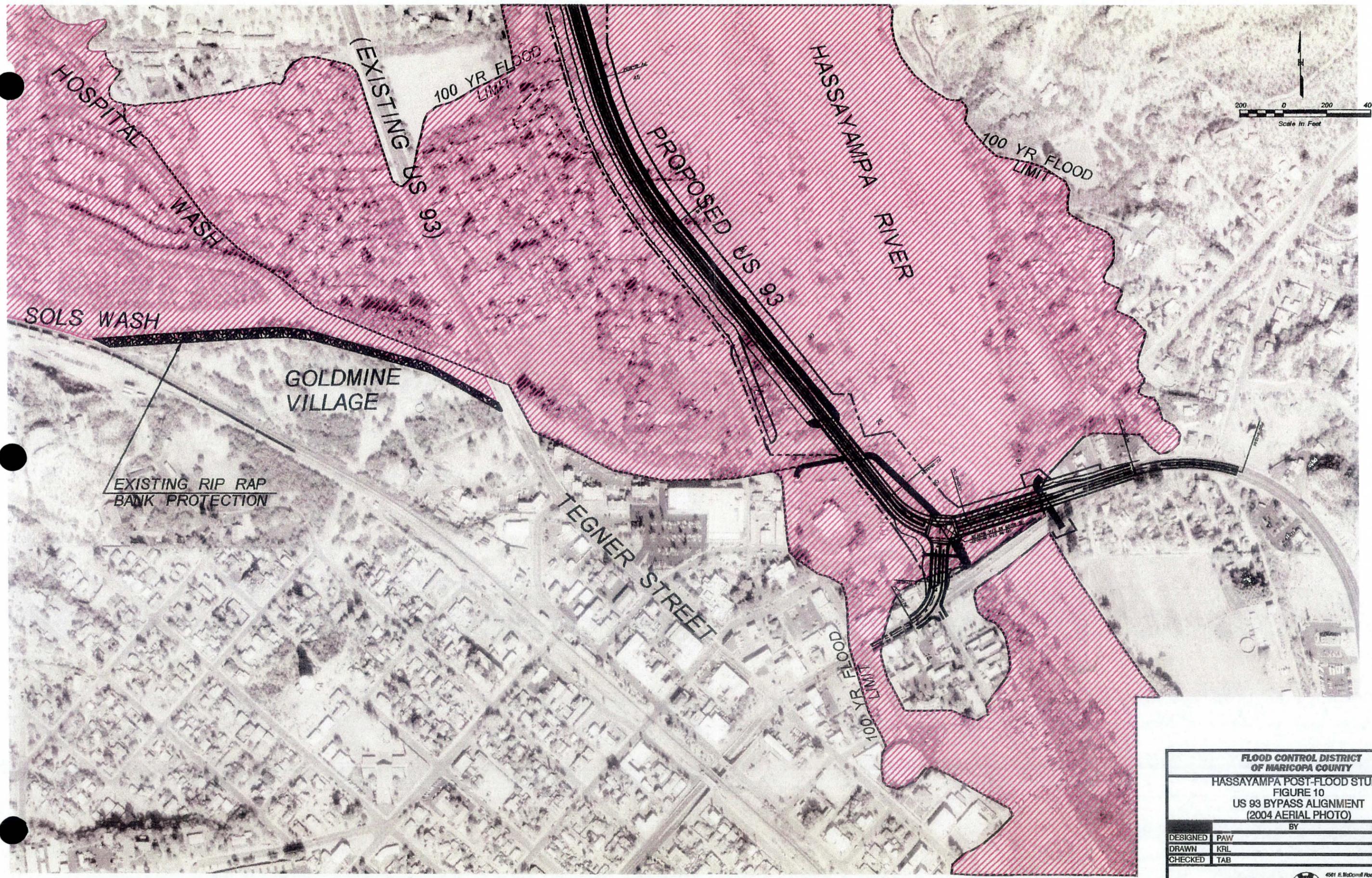
The bank protection along the east bank north of the US 60/93 Bridge does not provide 100-year protection. The 100-year floodplain remains unchanged in this area. This bank protection was constructed 10-feet high in some areas, and flow depths from the duplicate effective hydraulic model, created by West Consultants for their US 93 Bypass Report (Reference 5), show flow depths approaching 20-feet near the bridge. The HEC-RAS model from this Analysis is included in Appendix A.5.

5 FUTURE HASSAYAMPA RIVER PROJECTIONS

ADOT will be constructing the US 93 Bypass around Wickenburg in the next few years. This bypass will include a new bridge over the Hassayampa River and another new bridge over Sols Wash (Figure 10). The proposed bypass is designed to minimize impacts to the floodplain, but a river as large as the Hassayampa can develop significant meanders and bank changes in a single event, as witnessed in February of this year.

The US 93 Bypass will create a levee on the west bank of the Hassayampa River. The current design did not account for the new bank protection on the east bank of the river; it is not known how this bank protection will perform during large storm events.

As the Town of Wickenburg continues to grow, private developments are likely to encroach on the river and the increase the likelihood of flood damage. The watercourse master plan for this portion of the Hassayampa River should focus on providing guidance for development near the floodplain.



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

HASSAYAMPA POST-FLOOD STUDY
FIGURE 10
US 93 BYPASS ALIGNMENT
(2004 AERIAL PHOTO)

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

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6 RECOMMENDATIONS

6.1 Future Developments

The Town of Wickenburg is growing rapidly and many new developments are planned within the City limits. There were 207 building permits granted in the 2004 fiscal year and more expected in 2005. At his time there are no known developments are planned near the Hassayampa River or Sols Wash. The Town of Wickenburg is not permitting new construction within the floodplain.

6.2 Additional Studies

It is a recommendation of this report that further studies be performed in the Wickenburg-Hassayampa River Corridor to reduce the potential for future flooding damage. The District's planned Hassayampa Watercourse Master Plan should address the following concerns:

- The impact of the Sols' Wash sediment deposits on the west bank of the Hassayampa River needs further analysis to better understand the interaction between the two watercourses. There needs to be a plan to address the sediment deposits from Sols Wash. Possibly, a plan could be developed to monitor/maintain sediment levels at the Sols Wash confluence.
- The temporary dike protecting the Horspitality RV Park could incur damage during a minor to moderate flow events. Permanent bank protection should be considered to protect this property. The property owners are currently working with the NRCS to construct a permanent bank. After the completion of the permanent bank protection, additional analysis should be performed to determine its impact on future flow events along the Hassayampa River.
- The dumped riprap placed by ADOT seven miles south of the US 60/93 Bridge was an emergency protection measure. The riprap bank protection was not engineered. The material is not a durable stone but rather fractured cement stabilized alluvium (CSA), which was placed during the flood to halt the advance of erosion on the highway embankment. The riprap is ADOT's property and was placed by them to protect their highway. If it's within the jurisdiction of the District, the bank protection should be analyzed to determine if it is adequate, or needs to be replaced.
- The east bank protection north of the US 60/93 Bridge was placed as an emergency protection measure and was not constructed as a long-term solution nor designed for a specific level of protection. As a result, it is not known what level of protection it provides. This bank protection is not a suitable counter measure for long-term scour from flow events and may be undermined. ADOT should consider re-analyzing this area to determine the impact it has on the Hassayampa River and the proposed US 93 bypass design. The District should include review of ADOT's US 93 Bypass design as part of the WCMP.

6.3 Additional Data

Due to the short contract duration and lack of response for data requests, the following additional data should be collected and analyzed as part of the WCMP.

- ADOT Contact Prints of US 60/93 Bridge in Wickenburg. (1963, 1977, 1990,1995, & 2001)
- Supplemental Survey for the improvements along Jack Burden Road (Yost & Gardner Engineer).
- Permanent improvement plans for Jack Burden Road. (Town is preparing bid documents)
- The complete project billing worksheets by the Town of Wickenburg for the 2005 flood mitigation.
- Copy of the bill for the temporary dike construction for the Horspitality RV Park.
- Cost estimates for permanent bank protection for the Horspitality RV Park.
- As-built drawings for the permanent bank protection for the Horspitality RV Park once it is constructed.
- Any future correspondence or agreements between the Town of Wickenburg and the Arizona Department of Emergency Management.
- Town of Wickenburg Zoning Map.

7 REFERENCES

1. *Storm Report : February 2005*, Flood Control District of Maricopa, February 2005.
2. *Flood Insurance Study Maricopa County, Arizona, and Unincorporated Areas*, Federal Emergency Management Agency (revised July 19, 2001).
3. *Flood Insurance Study Town of Wickenburg, Arizona, Maricopa County*, Federal Emergency Management Agency, (July 1977, revised 3/29/1983).
4. *Flood Insurance Study Yavapai County, Arizona, and Unincorporated Areas*, Federal Emergency Management Agency.
5. *US-93 Interim Wickenburg Bypass Bridge Hydraulics and Bank Protection Report (Draft)*, West Consultants, March 2005.
6. *Sols Wash Candidate Assessment Report*, Aztec Engineering, August 2004

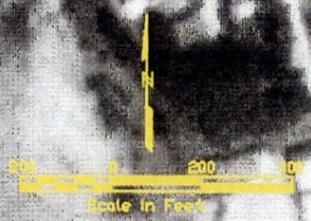


N.T.S.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 11
1953-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

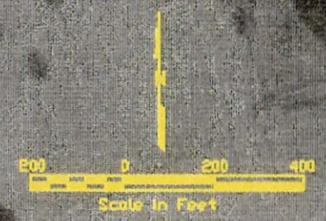
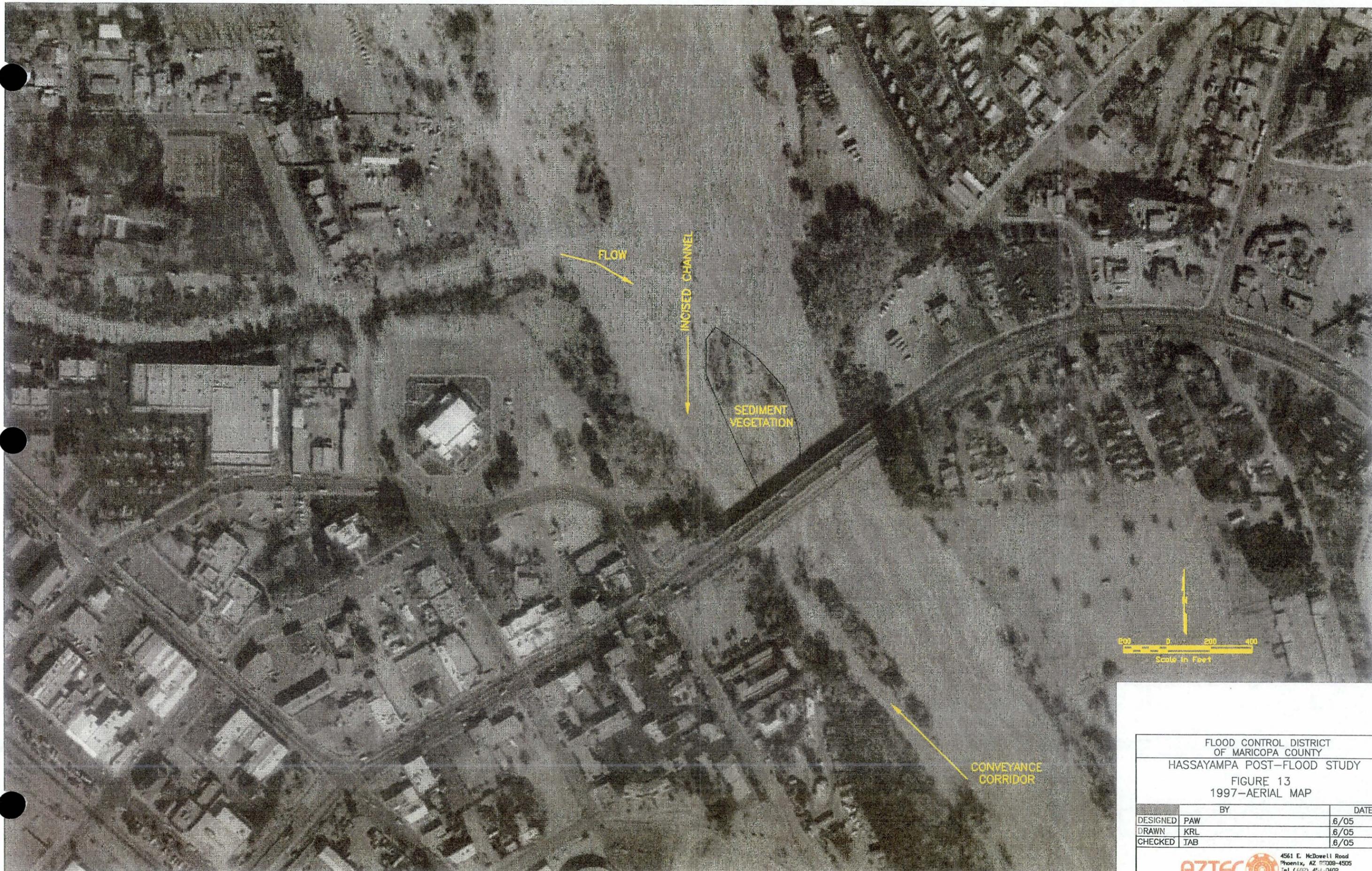
AZTEC  4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403
www.aztec.us



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 12
1993-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

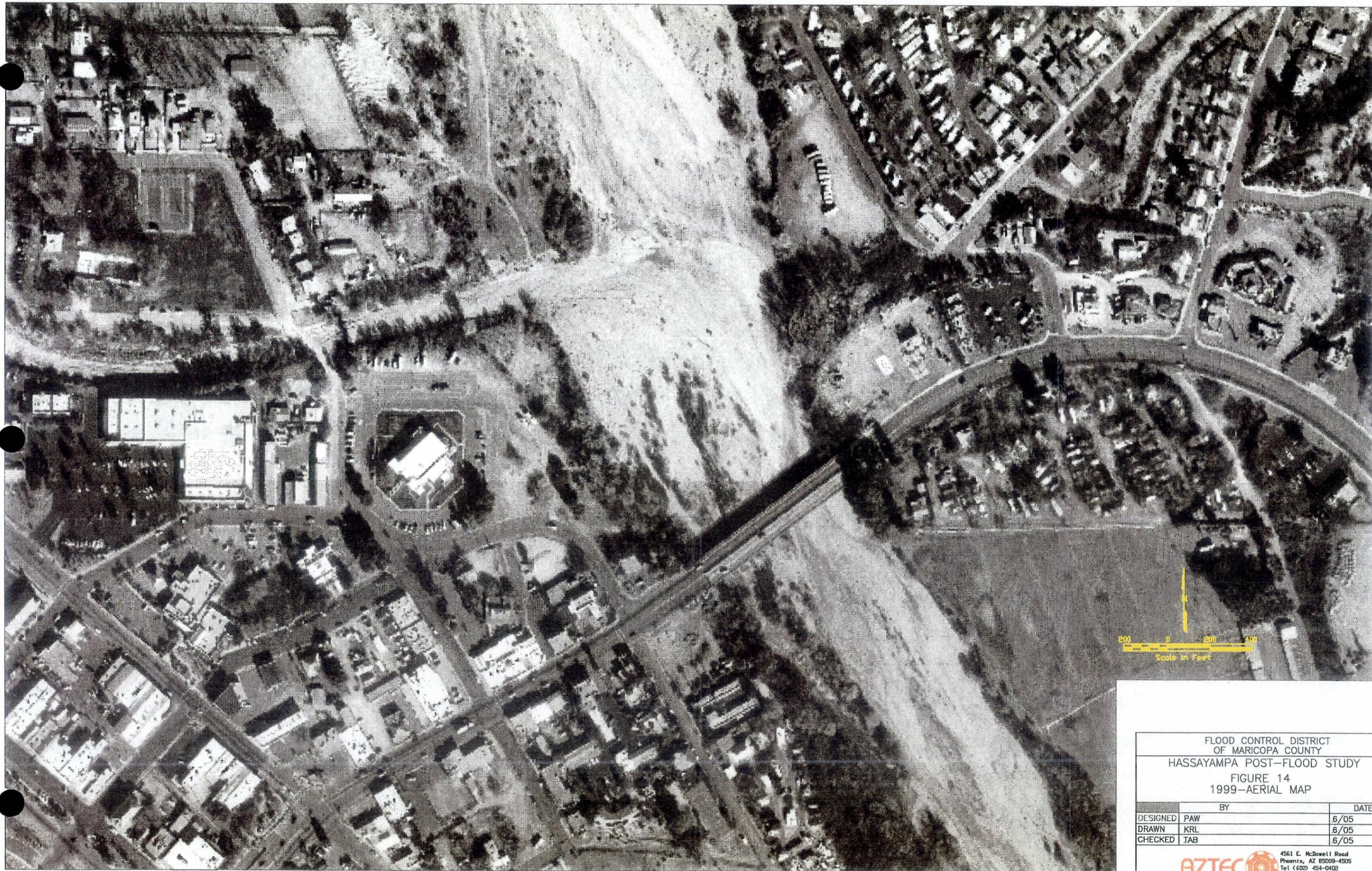
AZTEC  4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403
www.aztec.us



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 13
1997-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

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Fax (602) 454-0403
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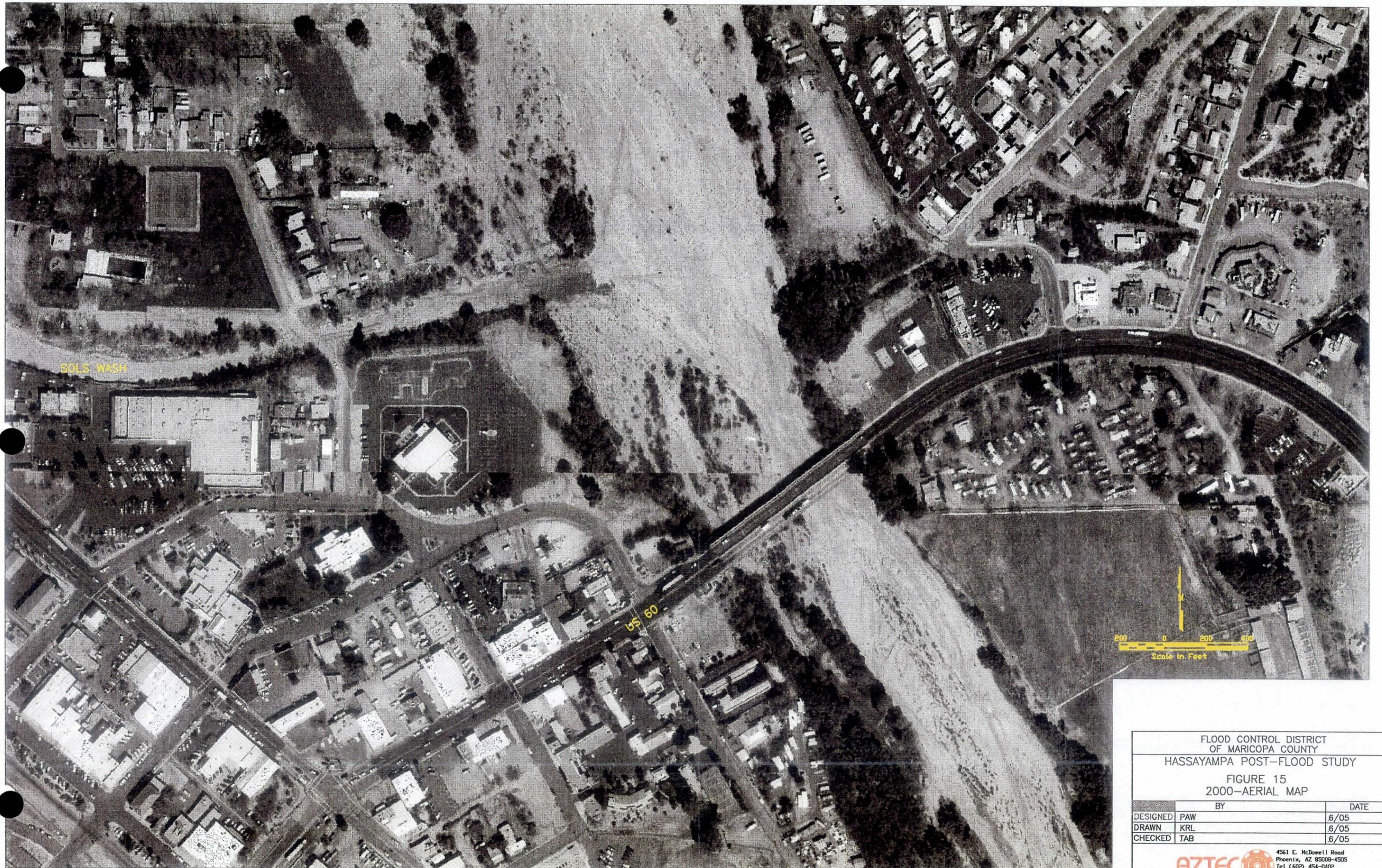


800 0 200 400
Scale in Feet

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 14
1999-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

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Fax (602) 454-0403
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SOLS WASH

55 60

Scale in Feet

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 15
2000-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

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Fax (602) 454-0403
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FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 16
2001-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

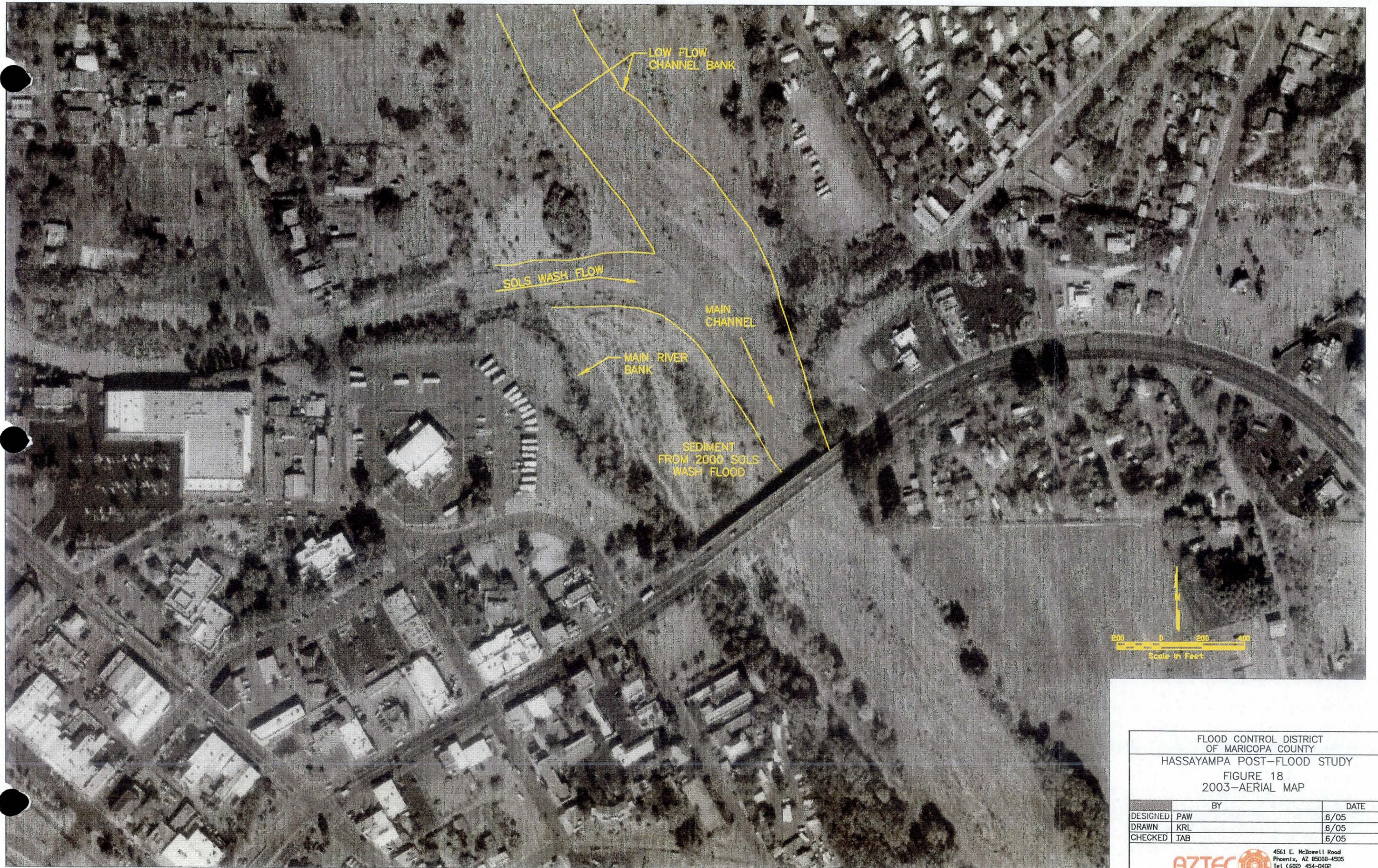
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Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403
www.aztec.us



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
HASSAYAMPA POST-FLOOD STUDY
FIGURE 17
2002-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

AZTEC 4561 E. McDowell Road
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Fax (602) 454-0403
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FLOOD CONTROL DISTRICT
 OF MARICOPA COUNTY
 HASSAYAMPA POST-FLOOD STUDY
 FIGURE 18
 2003-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

AZTEC 4561 E. McDowell Road
 Phoenix, AZ 85008-4505
 Tel (602) 454-0402
 Fax (602) 454-0403
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0 200 400
 Feet
 South is Up

FLOOD CONTROL DISTRICT
 OF MARICOPA COUNTY
 HASSAYAMPA POST-FLOOD STUDY
 FIGURE 19
 2004-AERIAL MAP

	BY	DATE
DESIGNED	PAW	6/05
DRAWN	KRL	6/05
CHECKED	TAB	6/05

AZTEC 4561 E. McDowell Road
 Phoenix, AZ 85008-4505
 Tel: (602) 454-0402
 Fax: (602) 454-0403
 www.aztec.us



APPENDIX A : DATA COLLECTION

A.1 Town of Wickenburg Flood Mitigation Information



TOWN OF WICKENBURG

155 N. Tegner, Ste. A • Wickenburg, Arizona 85390 • (928) 684-5451
Phoenix Line (602) 506-1622 • FAX (602) 506-1580
Voice & TTY (928) 684-5411

June 14, 2005

Lou Trammell, Deputy Director
Arizona Department of Emergency Management
5636 E. McDowell Road
Phoenix, AZ 85008

Dear Mr. Trammell:

We would like to request that ADEM appeal to FEMA to reconsider their denial of public assistance for the Winter Storms 2005 (FEMA-1586-DR-AZ) for the Town of Wickenburg. Wickenburg is approximately 54 miles northwest of Phoenix. Even though we are at the tip of Maricopa County, on the border of Maricopa and Yavapai County, we are still considered a rural community. We had a population of 5680 estimated in 2004, up from 5082 from the census in 2000. The population for Maricopa County was 3,072,149 and Yavapai County was 167,517 based on the 2000 census. The median household income for Wickenburg is \$34,340.

Our estimated annual budget for 2004-2005 was \$5,544,337. The total estimated cost of the damage to town roads, water pipes and pumps is \$2,400,000. With only the help of ADEM, the cost to the town will be approximately \$600,000. We are currently going through our 2005-2006 budget process. We have had to make serious cut backs in order to adjust to this loss. We were not able to add any personnel for the next year and had to freeze the hiring of one police officer vacancy. We have had to put off replacing roofs in need of repair, updating our zoning code, adding police vehicles, adding a police dog, improving roads in need of repair, replacing manholes and lift station maintenance that were in a program to be done this next year and water system improvements. We have had to increase the cost of sanitation, sewer, water and electric in order to make up some of the loss. This has really been a hardship in our small town. All the projects listed above that were cut were projects that had been scheduled to be completed in the next budget year. The managers were told that there wouldn't be any new projects that would even be considered, so those weren't even brought up during the budget sessions. We hope you are able to help us recover some of the money that we will have to pay out with only the ADEM help and hopefully get FEMA to include the Town of Wickenburg in the other emergency areas, like Yavapai County, that were hit by the winter storms of 2005 and were reimbursed since they were in smaller populated areas.

If you have additional questions, please feel free to contact me at 928-684-5451 x522.

Thank you,

Shane Dille



TOWN OF WICKENBURG

155 N. Tegner, Ste. A • Wickenburg, Arizona 85390 • (928) 684-5451
Phoenix Line (602) 506-1622 • FAX (602) 506-1580
Voice & TTY (928) 684-5411

To: Sallie McGuire, USACE

From: Lyle Murdock, Floodplain Administrator, Town of Wickenburg

Sallie, the actual form did not come in the sent file. The following information is for the Emergency 404 Permit:

Town of Wickenburg
155 N. Tegner St.
Suite A
Wickenburg, Az. 85390
Main Phone: 928-684-5411

Location of Work: Work is located east of the Hassayampa River, North of U.S. Highway 60, along Jack Burden Rd.

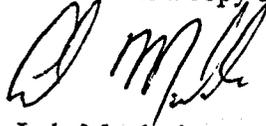
Description of Work: Installation of a LEVY to protect Life and Life sustaining Utilities and Emergency Services. This work entails the hardening of the River Banks from Thurber Rd. to Constellation Rd. along Jack Burden Rd. Replacement of Temporary and Permanent Sewer and Water, Temporary Power Poles for both Residential (within the Town of Wickenburg's own Power Grid), and the replacement of one of the Town's Water Well's which was knocked out of service due to Flood Damage, and the APS 69 Line Sub-Station Feed. Methods are use of rock, and concrete slurry to bind the rock. See attached detail for areas of work.

Threat: There are currently 2 addition storms moving into the area which will end around the 24th of Feb. 2005 according to the NWS. Jack Burden Rd. is the only Hard Rd. for access to this area for Emergencies. The area affected if not addressed now is, with additional Flooding from the **pending storms**, could also affect the bridge approach at US 60 which is the only access in the area to connect the Town of Wickenburg across the River within the City Limits.

Environmental Impacts: Along the River Bank in the affected area we have to remove some vegetation and dead trees to install the protection Barrier for Jack

Burden Rd. Impact to the area will be held to a minimum and limited to the installation of these Protection Devices.

Enclosed is a copy of the area of work and an aerial view of the area.



Lyle Murdock
Floodplain Administrator, Building Safety
Town of Wickenburg

Lyle Murdock

From: "McGuire, Sallie SPL" <Sallie.McGuire@spl01.usace.army.mil>
To: <lyle@ci.wickenburg.az.us>
Cc: "Fowler, Ronald W SPL" <Ronald.W.Fowler@spl01.usace.army.mil>
Sent: Tuesday, February 15, 2005 4:46 PM
Attach: RGP63_2003.pdf
Subject: Emergency 404 permit

Mr. Murdock:

The Corps of Engineers Regulatory Section has a Regional General Permit for those activities necessary to prevent the loss of life and property. I have attached the permit. On page 2 are the items that need to be submitted in the notification: Name, address, phone, location of work, description of threat, description of methods to rectify the situation and estimate of environmental impacts from the activities.

On Wednesday February 16 please contact Ron Fowler for additional information at (602) 640-5385 x226.

<<RGP63_2003.pdf>>

Sallie McGuire

Senior Project Manager

U.S. Army Corps of Engineers

3636 N Central Ave, Suite 900

Phoenix, AZ 85012-1939

(602) 640-5385 x221

fax: (602) 640-2020

sallie.mcguire@usace.army.mil

www.spl.usace.army.mil/regulatory

2/16/2005

Jack Bur Rd.
Project Nr. 255174

Equipment	Code	Quantity	Unit	Hours	Rate	OT Hours	OT Rate	Total
Dozer, D9	8256	1	Hr	83.75	\$205.00			\$17,168.75
Excavator, Hydraulic	8284	1	Hr	66.5	\$185.00			\$12,302.50
Grader	8333	1	Hr	64	\$100.00	9	\$125.00	\$7,525.00
Compactor	8225	1	Hr	41	\$80.00			\$3,280.00
Dump Truck, Off Road Articulated	8726	2	Hr	112	\$170.00	62	\$210.00	\$31,955.00
Loader, 950	8395	1	Hr	64	\$205.00	40	\$205.00	\$21,268.75
Loader, 966	8396	1	Hr	119	\$205.00	6	\$205.00	\$25,625.00
Loader, 988	8400	1	Hr	122.75	\$205.00			\$25,163.75
Truck Dump	8722	9289.65	Ton	Fee per hauled ton	\$4.20			\$39,016.53
Trailer, Dump	8592	19577.98	Ton	Fee per hauled ton	\$14.90			\$291,711.90
Trailer, Dump, Custom	8592	760.7	Ton	Fee per hauled ton	\$10.21			\$7,766.75
Trailer, Dump	8592	7485.39	Ton	Fee per hauled ton	\$13.20			\$98,807.15
Truck, Water	8781	1	Hr	168	\$100.00		\$125.00	\$16,800.00
Loader, Backhoe Wheel	8572	1	Hr	88	\$62.50		\$80.00	\$5,500.00
Sweeper, Pavement	8157	1	Hr	16	\$125.00			\$2,000.00
Truck, Pickup	8804	1	Hr	192.5	\$35.00			\$6,737.50
Excavator, Hydraulic 330	8284	1	Hr	12	\$150.00			\$1,800.00
Motor Grader	8333	1	Hr	57	\$115.00			\$6,555.00
Grade Tractor	8401	1	Hr	28	\$60.00			\$1,680.00
Barrier/Sign Rental fr. Action		1	Unit		\$5,714.45			\$5,714.45
Skidsteer		1	Hr	44	\$50.00			\$2,200.00

Subtotal: \$630,578.03

Material Purchase				
BC	6912.64	Tons	\$6.20	\$42,858.37
Tip Rap, 6 to 12 inches	19521.1	Tons	\$8.82	\$172,176.10
Boulders, Kilauea	7485.39	Tons	\$12.80	\$95,812.99
Bit Run/Screen Fill	2998.29	Tons	\$3.90	\$11,693.33
Boulders, Custom	760.7	Tons	\$32.50	\$24,722.75
Concrete Rip Rap	21.68	Tons	\$4.00	\$86.72
7 Rock/Septic Rock	479.86	Tons	\$13.00	\$6,238.18
.5 Sack Grout	80	Yds	\$81.50	\$6,520.00
Timber, Shoring	1	Ls	\$335.00	\$335.00

Jack Bur Rd.
Project Nr: z55174

Cattle Guard	1	Ea		\$8,733.33	\$8,733.33
Guard Rail	350	Lf		\$29.69	\$10,391.50
Meals from Hayes Food Truck	1	Ls		\$2,429.66	\$2,429.66
Replacement of Hitching Posts	1	Ls		\$337.20	\$337.20
Stagging Area Asphalt Replacement	1	Ls		\$11,000.00	\$11,000.00

Subtotal: \$393,335.13

Misc. Equipment

Steel Plates	12	Ea/Day	50	\$74.40	\$3,720.00
Mobilization Cost		Total			\$6,264.00
Concrete Saw	1	Ea		\$150.00	\$150.00
Transportation Cost	1	Ea		\$500.00	\$500.00
Permit	1	Ea		\$35.00	\$35.00

Subtotal: \$10,669.00

Contractor Labor/ Operators Time&Material

Jim Gibson	46	\$21.60	12	\$32.40	\$1,382.40
William Smith	31.5	\$24.30			\$765.45
Roger Stevens	58	\$44.72			\$2,593.76
Harry Gordon *	6	\$24.30			\$145.80
Eduardo Ramos *					
Victor Virgen *					
Juan Sanchez *					
Luis Monroy *					
Rafael Guzman *					
Delly Hill *					
Paul Clark *					
John Nelson *					
Chris Miranda *					
Rose Viguera *					
Greg Gladden *					
Willie Green	98	\$85.00	49	\$127.50	\$14,609.38
Jim Wilkins	90	\$50.00			\$4,500.00
Mike Merrett *					
Kevin Schuck	48	\$31.25	34	\$46.88	\$3,093.92
John Hardee	64	\$26.74	47	\$40.11	\$3,576.48

Jack Bur Rd.
Project Nr. 205174

Chuck Antos	56	\$24.04	47	\$36.06	\$3,024.83
Jeff Barnes, JEB Construction	13	\$53.33			\$693.29
				Subtotal:	\$34,385.30
				Total:	\$1,068,967.46

Indicates Equipment Operators. Time is included with the cost of equipment.



A.2 District's February 2005 Storm Report



Hassayampa River in Wickenburg, 02/14/2005, D. Gardner

Flood Control District of Maricopa County

Stephen D. Waters, Engineering Division, Flood Warning Branch

Storm Report : February 2005



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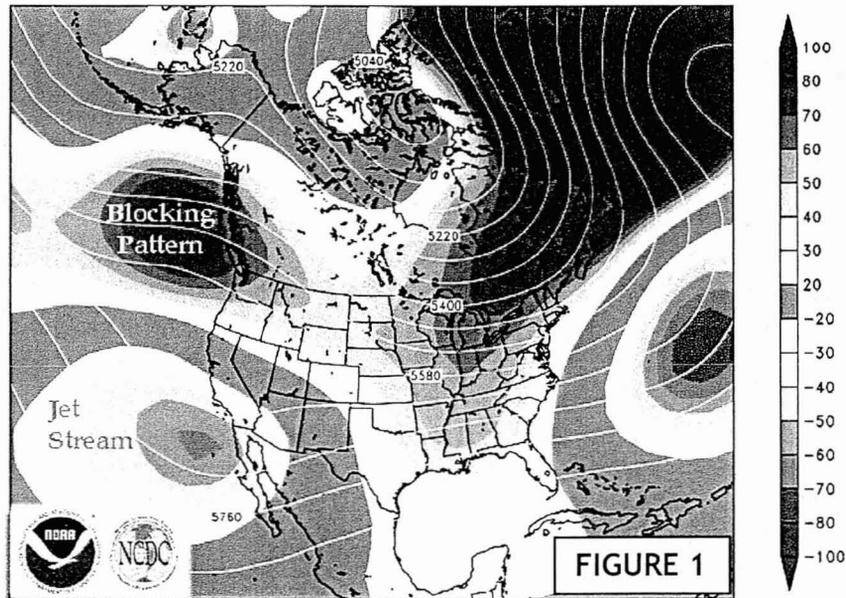
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A special thank you to members of the NWS, USGS, and NRCS for supplying several of the above figures.

METEOROLOGY

The fall and winter months leading up to February 2005 were well above normal in terms of rainfall. A persistent blocking pattern (Figure 1) had set up off the coast of British Columbia, causing a split in the jet stream. The polar jet was forced over Alaska, while the Pacific jet entered the United States over southern California and Arizona. Storms forming in the gulf of Alaska were forced southward, where their counter-clockwise circulation gathered-up large amounts of moisture from the tropical Pacific. This phenomenon is often referred to as the "Pineapple Express" (Figure 2). Contributing to this effect were a weak El Niño in the east-central Pacific, and a relatively strong episode of a tropical disturbance known as the Madden-Julian Oscillation (MJO). From early January 2005, the MJO over the central Pacific gradually shifted eastward toward the west coast of the US, allowing passing storms to tap deep tropical moisture.

500 Millibar Heights and Anomalies (in meters)
(From NCEP Reanalysis)



February 2005

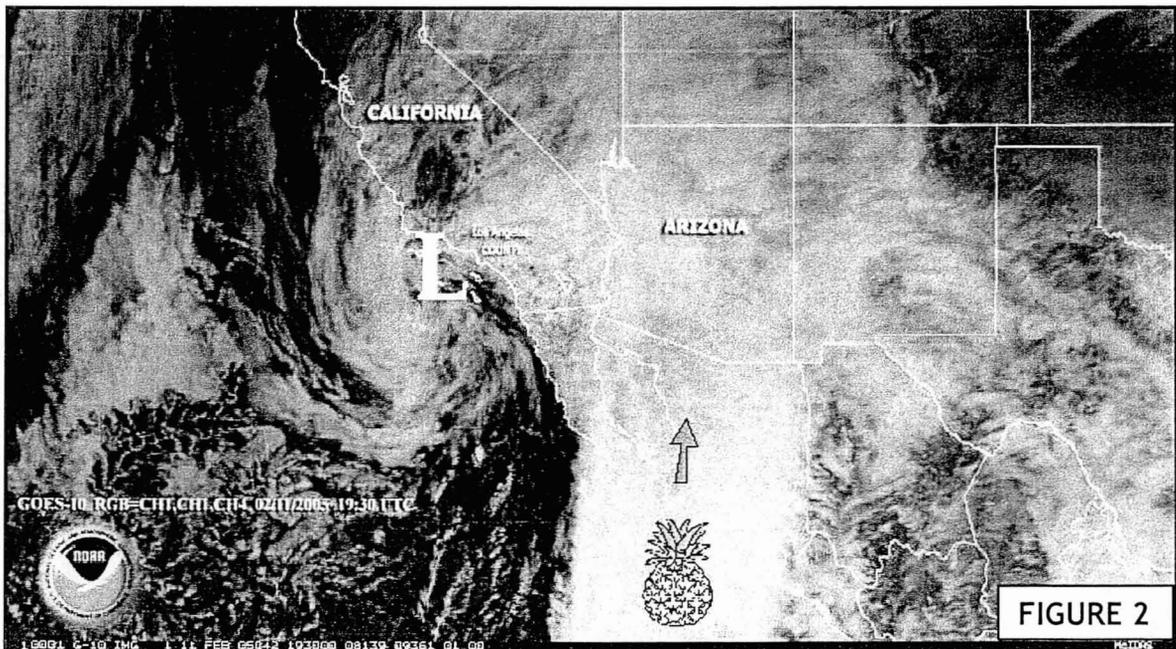


Table 1 - Climatological Report for February 2005 (From NWS Phoenix WFO)

CXUS55 KPSR 021845 CCC
CLMPHX

MONTHLY CLIMATOLOGICAL REPORT...CORRECTION
NATIONAL WEATHER SERVICE PHOENIX AZ
1145 AM MST TUE MAR 2 2005

PHOENIX WEATHER STATISTICS FOR FEBRUARY 2005

...FEBRUARY 2005 HAD 3.01 INCHES OF RAIN MAKING IT THE 5TH WETTEST
FEBRUARY ON RECORD. THE WETTEST FEBRUARY ON RECORD WAS IN 1905 WHEN
4.64 INCHES FELL. OTHER HIGHER AMOUNTS IN FEBRUARY WERE 3.71 INCHES
IN 1931...3.18 INCHES IN 1935 AND 3.15 INCHES IN 2003

AVERAGE MAXIMUM TEMPERATURE	67.0	NORMAL	71.4
AVERAGE MINIMUM TEMPERATURE	51.4	NORMAL	48.4
AVERAGE MONTHLY TEMPERATURE	59.2	NORMAL	59.9
DEPARTURE FROM NORMAL	MINUS 0.7	DEGREES	
HIGHEST AVERAGE MONTHLY TEMPERATURE	66.0	IN 1991	
LOWEST AVERAGE MONTHLY TEMPERATURE	48.6	IN 1939	
HIGHEST TEMPERATURE THIS MONTH	72	ON THE 9TH...16TH AND 17TH	
LOWEST TEMPERATURE THIS MONTH	46	ON THE 8TH	
RECORD HIGH TEMPERATURE FOR MONTH	92	ON THE 27TH IN 1986 AND THE 25TH IN 1921	
RECORD LOW TEMPERATURE FOR MONTH	24	ON THE 8TH IN 1933 AND THE 7TH IN 1899	
NUMBER OF DAYS WITH MINIMUM TEMPERATURE 50 OR LOWER	11		
NUMBER OF DAYS WITH MINIMUM TEMPERATURE 55 OR HIGHER	5		
NUMBER OF DAYS WITH MAXIMUM TEMPERATURE 60 OR LOWER	2		
NUMBER OF DAYS WITH MAXIMUM TEMPERATURE 70 OR HIGHER	5		
COOLING DEGREE DAYS BASE 65	0	NORMAL	15
HEATING DEGREE DAYS BASE 65	156	NORMAL	169
SEASONAL TOTAL			4
SEASONAL TOTAL			798
TOTAL MONTHLY PRECIPITATION	3.01	INCHES	
NORMAL MONTHLY PRECIPITATION	0.77	INCHES	
DEPARTURE FROM NORMAL	PLUS 2.24	INCHES	
GREATEST PRECIPITATION IN 24 HOURS	1.05	INCHES	ON THE 18-19
PRECIPITATION YEAR TO DATE	4.86	INCHES	
DEPARTURE FROM NORMAL YEAR TO DATE	PLUS 3.26	INCHES	
GREATEST MONTHLY PRECIPITATION	4.64	INCHES	IN 1905
LEAST MONTHLY PRECIPITATION	0.00	INCHES	IN 2002 AND 3 PREVIOUS YEARS
NUMBER OF THUNDERSTORM DAYS	1	NORMAL	1
NUMBER OF MEASURABLE RAIN DAYS	11	NORMAL	4
PERCENT OF POSSIBLE SUNSHINE	56	NORMAL	80

AVERAGE WIND SPEED 6.0 MPH NORMAL 5.9 MPH
 HIGHEST PEAK GUST 33 MPH FROM THE WEST ON THE 23RD
 AND FROM THE EAST ON THE 2ND

HIGHEST BAROMETRIC SEA LEVEL PRESSURE 30.20 INCHES ON THE 2ND
 LOWEST BAROMETRIC SEA LEVEL PRESSURE 29.74 INCHES ON THE 5TH

RECORDS BROKEN OR EQUALLED DURING THE MONTH

DATE	TYPE	NEW RECORD	OLD RECORD	YEAR/YEARS
11	PRECIP	0.77 INCHES	0.54 INCHES	1915
19	PRECIP	0.93 INCHES	0.64 INCHES	1915

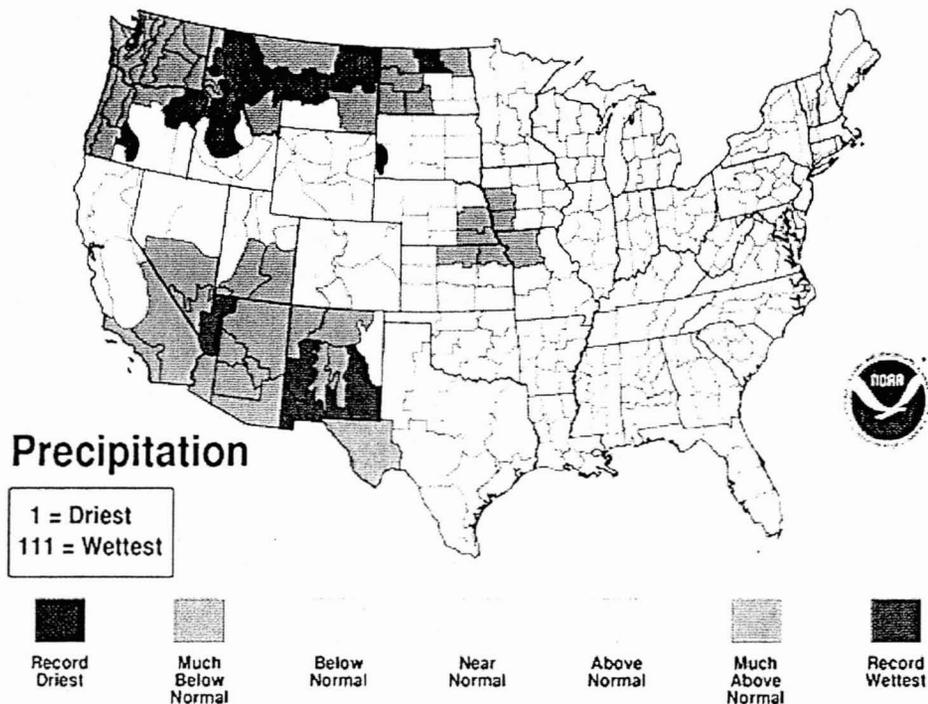
WFO PHOENIX AZ

Please note that this information is preliminary and unofficial.
 Official and certified climatological data can be accessed at:
[National Climatic Data Center](http://www.ncep.noaa.gov/cdo/)

Feb 2005 Divisional Ranks

FIGURE 3

National Climatic Data Center/NESDIS/NOAA



PRECIPITATION

Summary Statistics:

Total FCDMC Automated Rain Gages Installed: 284

Overall Percent Operational Automated Rain Gages for the Month: 99.68%

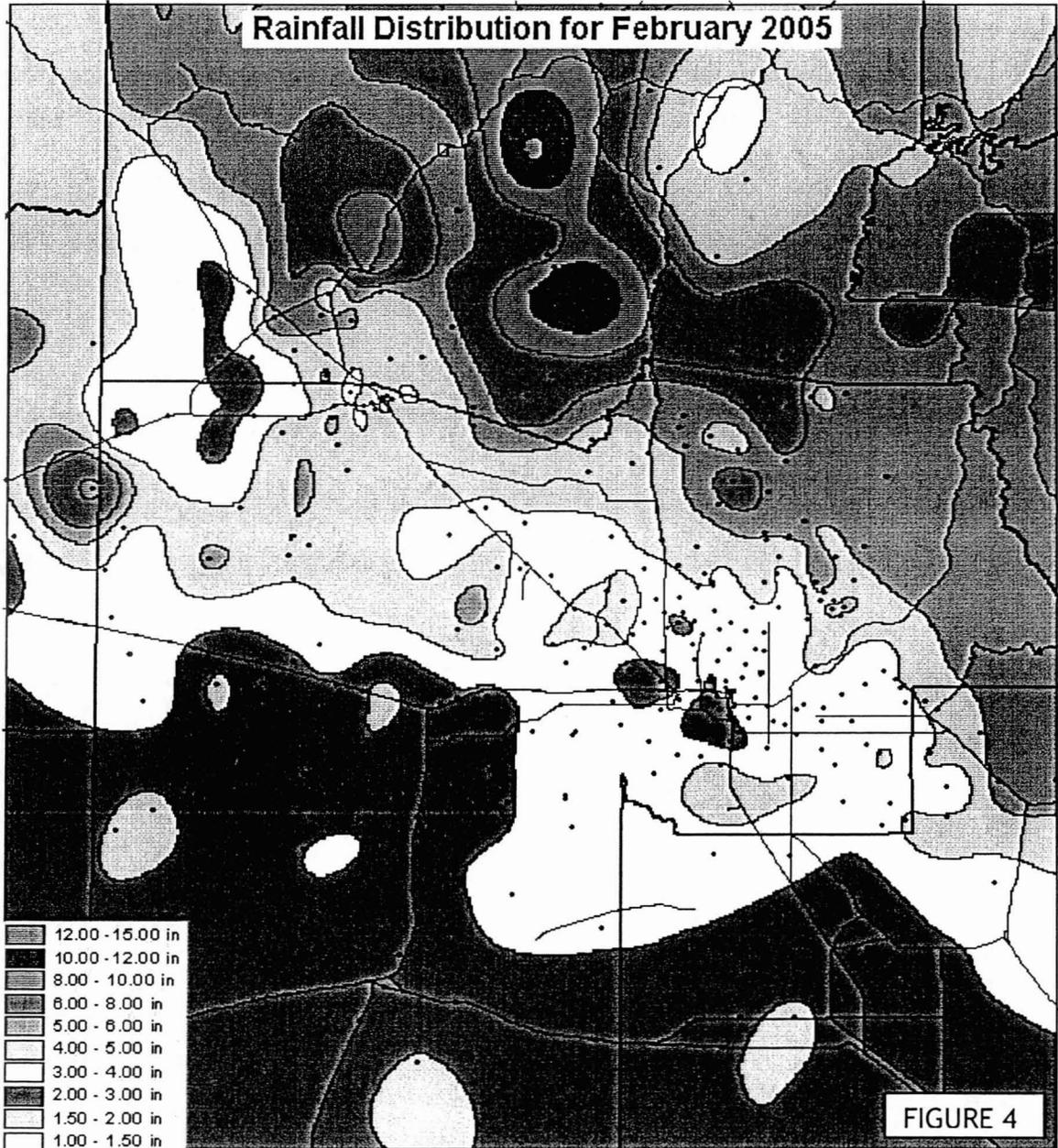
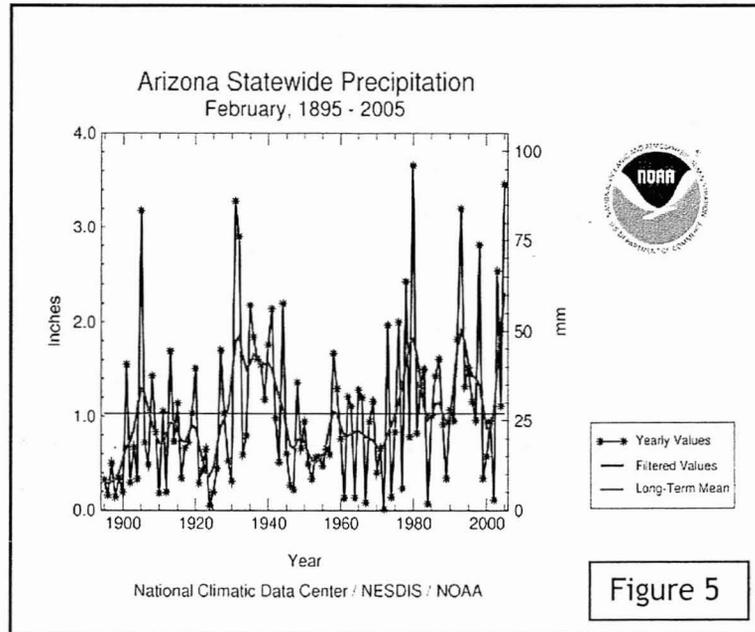


Figure 4 above was created with Arcview 3.2 and Spatial Analyst, using edited rainfall data from Flood Control District automated rain stations (black dots). Daily-total data for all stations for the month can be downloaded from the FCDMC website at: <http://156.42.96.39/alert/Rain/pcp0205.pdf>

Precipitation for the month of February, 2005 can be broken into three distinct storm periods. First, a minor storm brushed the northern parts of the County on Feb. 6th and 7th. The heaviest storm drenched central Arizona on the 10th through the 12th. Finally, a procession of storms affected the entire State from the 17th through the 24th, with slight breaks on the 21st and 22nd. Most ALERT stations recorded rainfall on at least 10 of the 28 days in February - many of the northern stations recorded rainfall on 14 or more days. Figure 5 below shows that, for all of Arizona, 2005 is second only to 1980 as the wettest February since records have been kept.



In Figure 6 below, the vertical green bars on the right show the number and magnitude of wet months since August of 2004. It is a striking contrast to the previous below normal (drought) months shown in red.

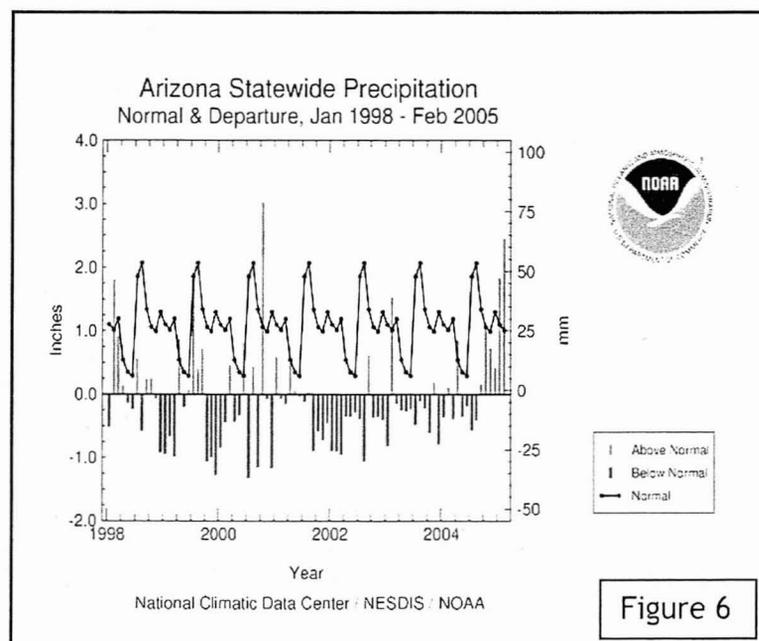


Figure 7

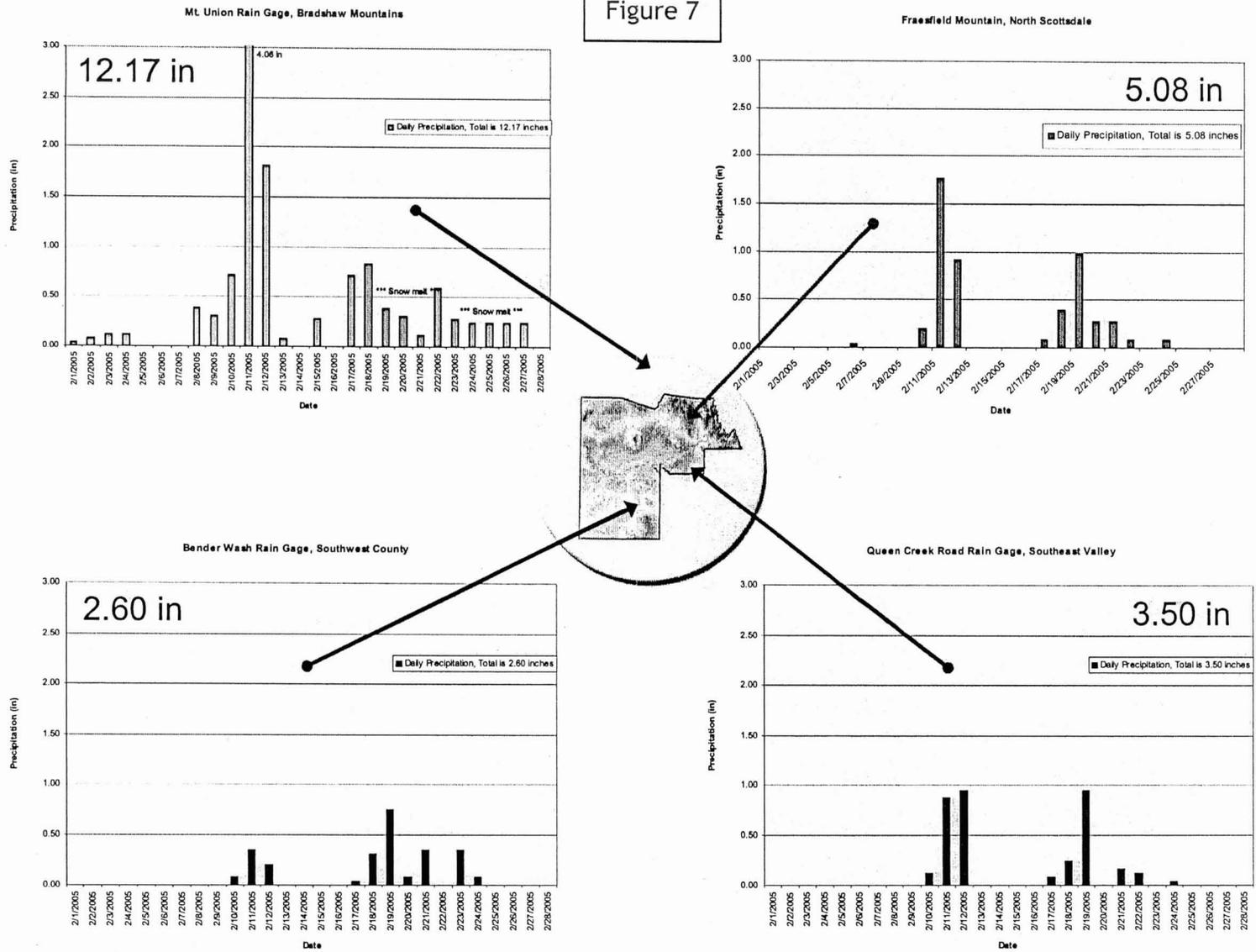
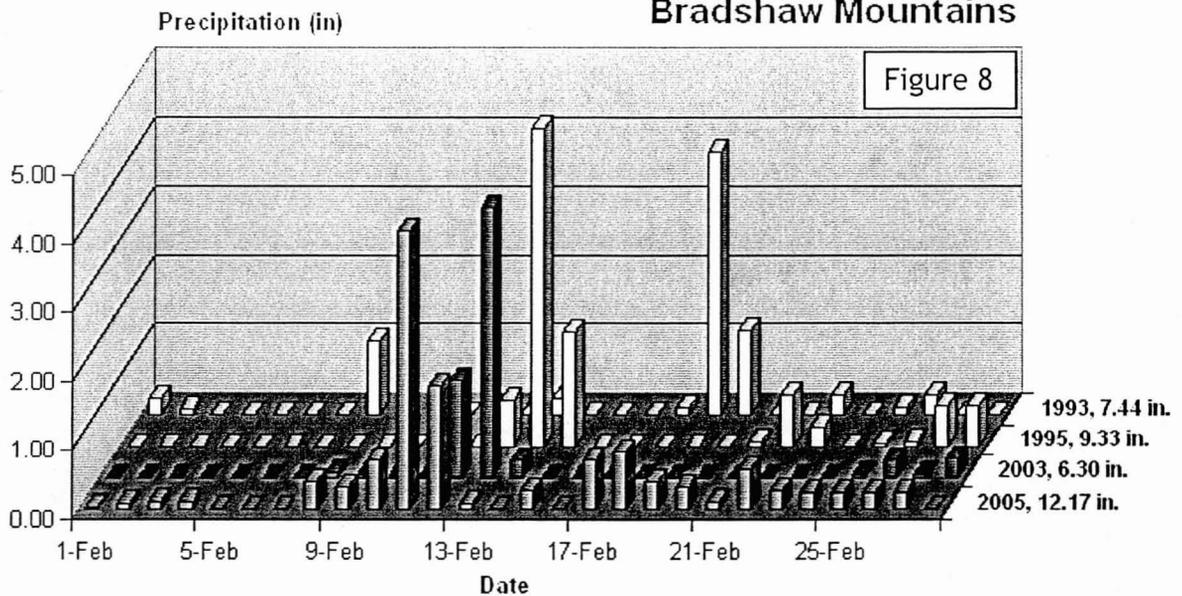
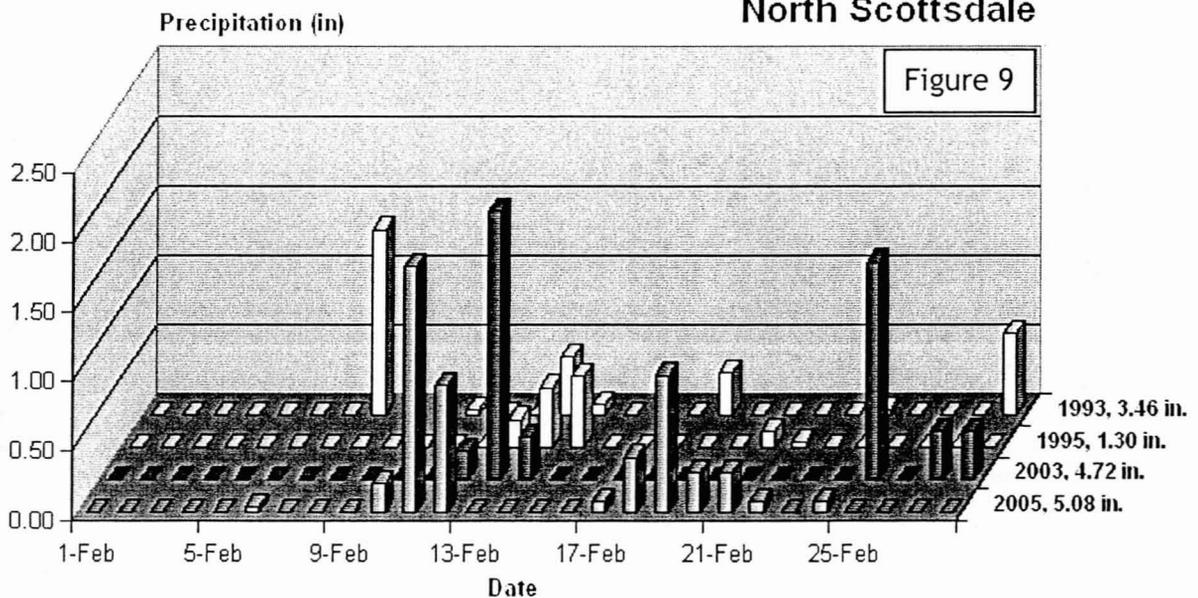


Figure 7 above shows daily total rainfall for February 2005 at four rain stations around the County. The bottom axis is days of the month from 1-28, and the left axis is daily rainfall from 0.00 to 3.00 inches.

Mt. Union Rain Gage Bradshaw Mountains

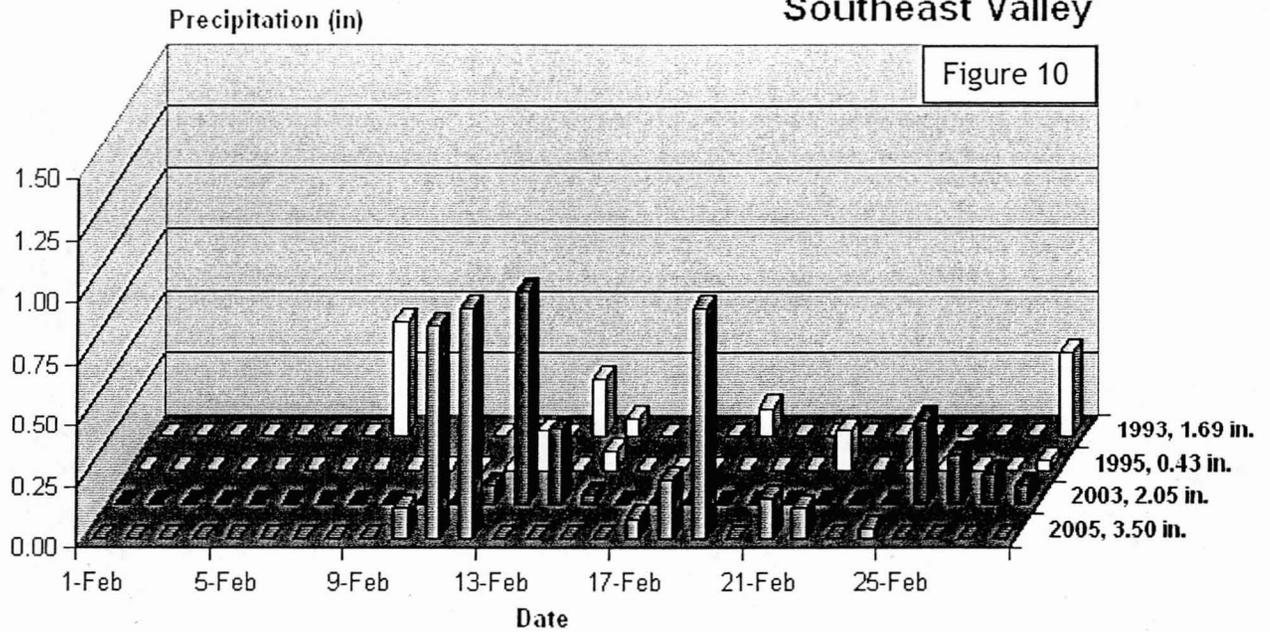


Fraesfield Mountain Rain Gage North Scottsdale

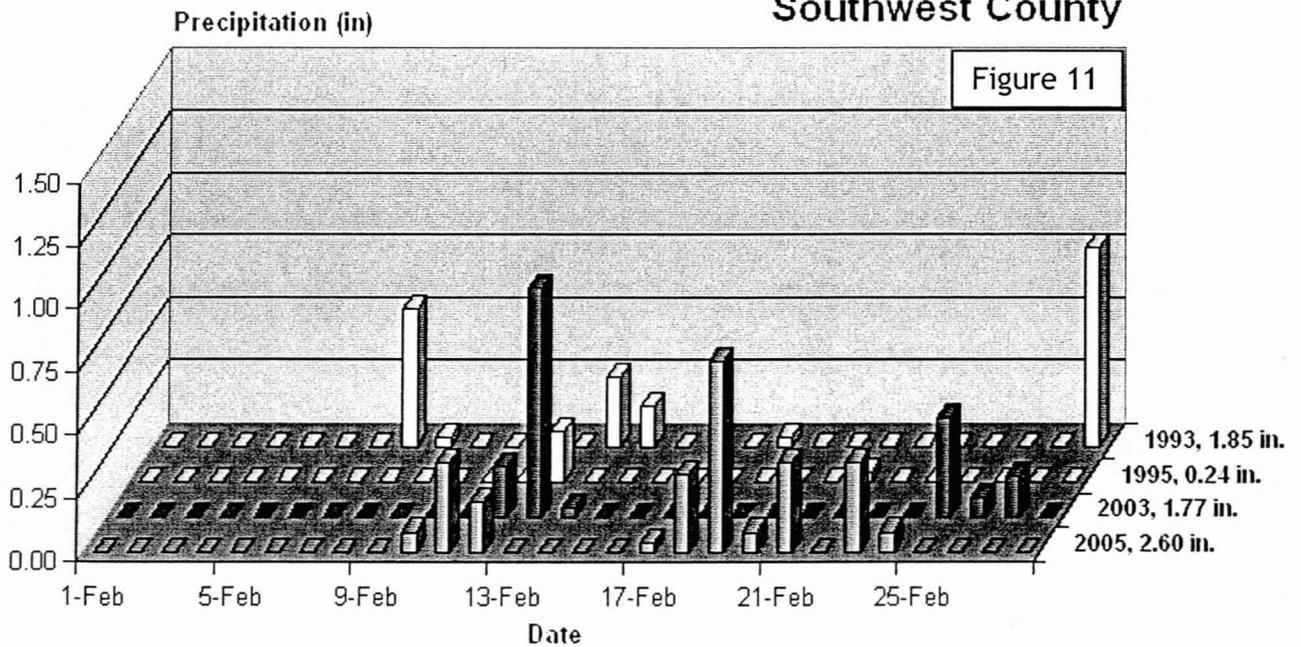


Figures 8 & 9 above, and 10 & 11 below, show daily rainfall values for February 2005 in comparison to three other recent wet Februaries. Note that in all four cases, February 2005 was the wettest, and that in most years the majority of precipitation fell in the 2nd and 3rd weeks of the month.

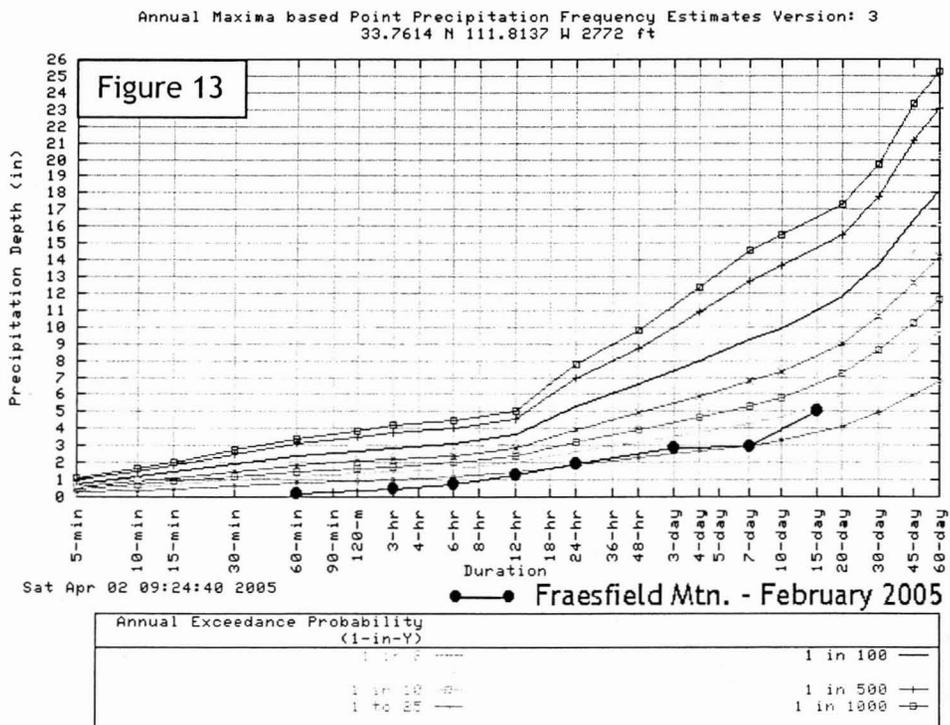
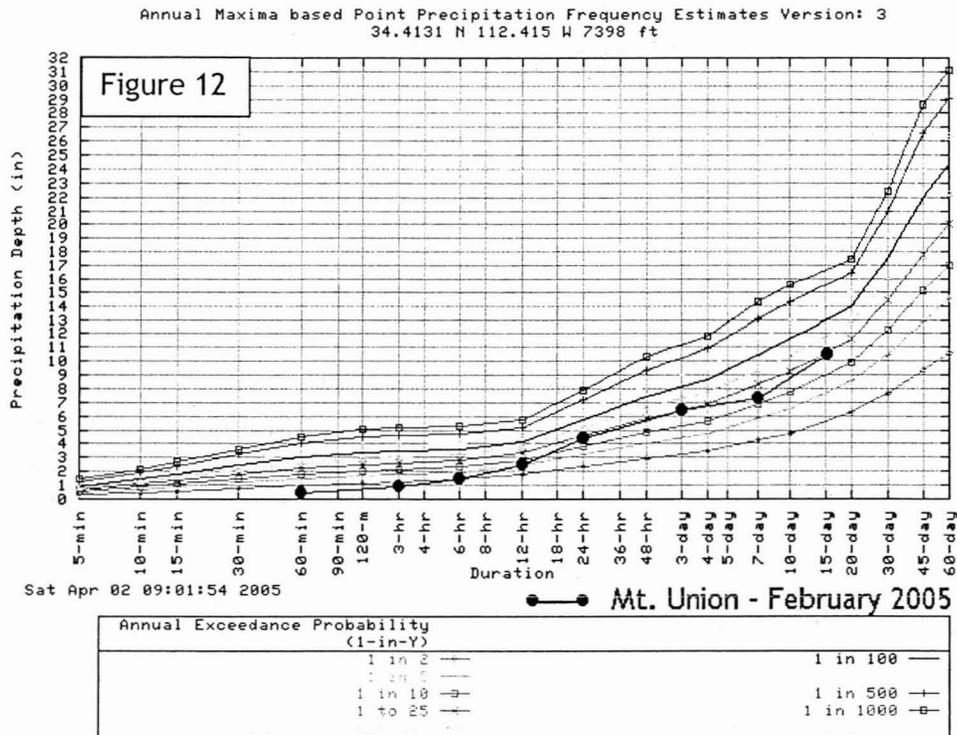
Queen Creek Road Rain Gage Southeast Valley



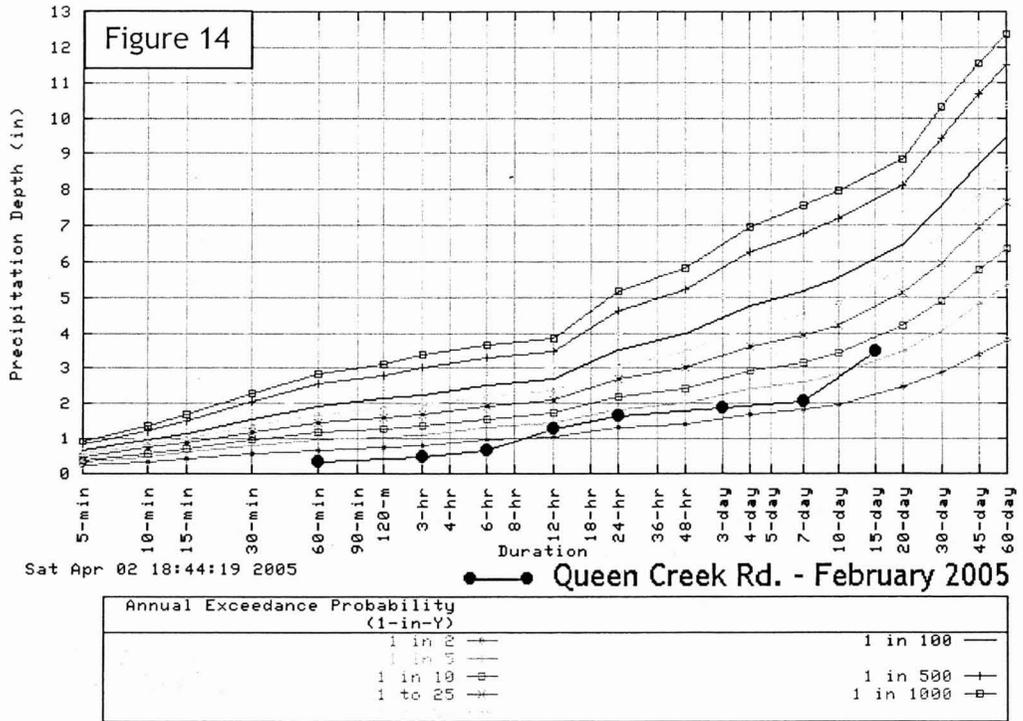
Bender Wash Rain Gage Southwest County



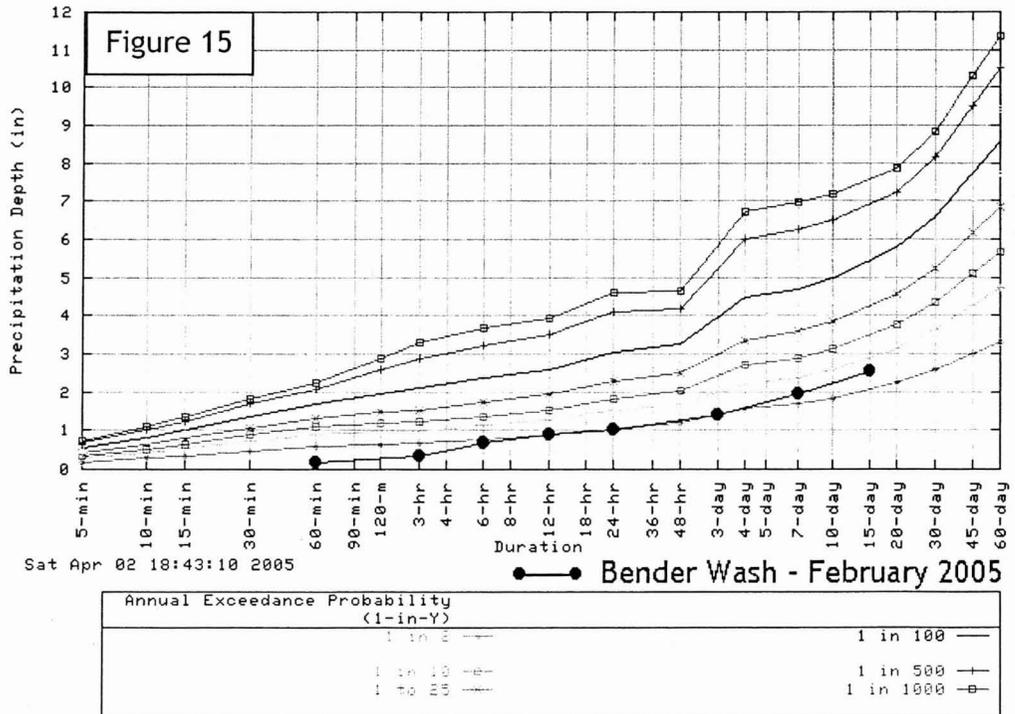
How did the precipitation events of February 2005 measure up in terms of return frequency? Take a look at Figures 12 - 15 below - graphs of recorded point rainfall plotted against frequency data at the same point from NOAA Atlas 14. Looking again at our four representative gages, Mt. Union, in the Bradshaw Mountains north of Phoenix, approximates a 25-year event for durations past 1 day. The other three gages, all within Maricopa County, are plot around the 2 and 5-year events for the same durations.



Annual Maxima based Point Precipitation Frequency Estimates Version: 3
 33.261 N 111.6289 W 1410 ft



Annual Maxima based Point Precipitation Frequency Estimates Version: 3
 32.91 N 112.5322 W 1338 ft



RUNOFF

Water-year 2005 began at the conclusion of six years of below normal rainfall in Arizona. October and November 2004, and January 2005, turned that around in a big way! At the start of Water-year 2005, Roosevelt Lake was at 28% of operating capacity, and the Verde River lakes (Horseshoe and Bartlett) were at 49%. By February 1st, Roosevelt had risen to 48% and the Verde system was at 88%. Through February, Roosevelt gained an additional 34% to 83%, and the Verde system gained 12% to become more than full, and releases from Bartlett became necessary. By April 1st, Roosevelt gained an additional 9% to 92% - it is expected to be full to it's operating pool by the end of the 2005 snowmelt season.

February 11-12, 2005

The most significant storm of the winter season dropped large amounts of precipitation on already wet watersheds. The Hassayampa River peaked during the late morning of February 12 of about 16,000 - 17,000 cfs, which translates to about a 10-year return period. Cave Creek had high flows of nearly 2,000 cfs at the two gages above Cave Buttes Dam. Martinez Creek had a peak runoff of 1,470 cfs. Queen Creek at CAP and Queen Creek at Rittenhouse had runoff from a significant impoundment at Whitlow Ranch Dam. Queen Creek at Rittenhouse had its first runoff event in many years. Also, because of the impoundment at New River Dam, New River at Bell Road showed decent runoff (1,500 cfs) for the first time in several years.

As for impoundments at dams, Whitlow Ranch Dam peaked at about 50 feet which is about 13% full. Rittenhouse FRS had a peak of 12.5 feet which is about 23% full. Cave Buttes Dam had a peak impound of about 31 feet or about 3% full. New River Dam had a peak impoundment of 20.7 feet or which is nearly 5% full.

February 19-23, 2005

This last of the series of moderate rain/runoff events produced average runoff from many of the urban watersheds such as Indian Bend Wash and the ACDC. Cave Creek had runoff in the 250 to 650 cfs range. The Salt River Project continued releases over Granite Reef Dam. Peaks were in excess of 10,000 cfs.

TABLE 2 - SUMMARY OF SELECTED IMPOUNDMENTS AT FCD STATIONS

STATION NAME	ID	PEAK Gage Ht. (feet)	PEAK OUTFLOW (cfs)	PEAK STORAGE (acre-feet)	PEAK CAPACITY (% full)	DATE - TIME
Adobe Dam	5534	4.23	192	44	< 1%	2/13 00:03
Apache Junction FRS	6673	2.65	19	2.0	< 1%	2/19 05:14
Casandro Dam	7133	2.09	11	5.8	4%	2/11 20:40
Cave Buttes Dam (1)	4899	31.0	266	1,480	3%	2/14 14:13
Crossroads Park Basin	6623	2.28	Pumped	17	4%	2/24 05:53
Dreamy Draw Dam	4803	6.72	100	0.0	< 1%	2/18 00:11
East Fork Cave Cr. #1	4648	0.86	8	1.0	2%	2/12 17:42
East Fork Cave Cr. #3	4683	0.25	8	0.0	< 1%	2/12 00:39
East Fork Cave Cr. #4	4658	3.00	52	4.0	5%	2/12 17:58

STATION NAME	ID	PEAK Gage Ht. (feet)	PEAK OUTFLOW (cfs)	PEAK STORAGE (acre-feet)	PEAK CAPACITY (% full)	DATE - TIME
Freestone Basin	6608	7.38	Pumped	27.3	13%	2/20 06:14
G&F Woolsey Peak	5063	4.45	Water Tank	---	---	2/12 06:01
Golden Eagle Park Dam	5978	4.95	354	2	2%	2/11 23:05
New River Dam	5609	20.71	1,578	2,245	5%	2/12 17:49
Phoenix Basin #3	4828	3.60	29	0.70	1%	2/18 00:42
Phoenix Basin #7	4853	1.20	7	0.30	< 1%	2/19 01:04
Powerline FRS	6683	3.22	42	240	5%	2/19 08:26
Reata Pass Dam	4938	3.22	11	Unknown	Unknown	2/19 03:56
Rittenhouse FRS	6703	12.58	120	919	23%	2/12 18:18
Signal Butte FRS	6628	5.70	0	41	2%	2/12 20:48
Spookhill FRS	4563	4.61	34	20.5	1%	2/12 13:08
Stoneridge Dam	5968	1.65	11	0.10	< 1%	2/11 22:39
Sunnycove FRS	5248	9.39	32	7.8	4%	2/12 08:13
Sunset FRS	5233	6.88	22	10.3	12%	2/12 06:52
Vineyard FRS	6688	3.58	67	335	10%	2/12 21:10
Whitlow Ranch Dam	6739	36.01	576	1,789	5%	2/16 10:08

(1) Gage was down prior to 2/16 due to a leak in the orifice line. Peak stage is from an observed high-water mark.

TABLE 3 - SUMMARY OF SELECTED STREAMFLOW READINGS AT FCD STATIONS

STATION	ID	PEAK STAGE (feet)	PEAK RUNOFF (cfs)	DATE - TIME
4 th of July Wash	5043	0.12	19	2/19 23:04
ACDC @ 14 th St.	4813	0.60	25	2/19 01:47
ACDC @ 43 rd Ave.	4823	1.12	202	2/24 04:03
ACDC @ 67 th Ave.	5523	4.10	698	2/19 06:57
Adobe Dam Outlet	5538	2.35	143	2/12 23:39
Agua Fria @ Buckeye Rd.	5403	1.51	140	2/14 04:02
Antelope Creek	7168	2.57	533	2/12 08:24
Berneil Wash	4688	1.02	192	2/19 02:07
Box Wash	5273	1.65	159	2/12 06:28
Bullard Wash	6863	0.41	48	2/24 01:25
Casandro Wash	7093	0.35	14	2/11 21:13
Cave Buttes Dam Outlet	4903	5.38	415	2/14 14:13
Cave Cr. near Cave Cr.	4918	4.68	2,785	2/12 04:21
Cave Cr. @ Spur Cross	4923	9.40	2,963	2/12 02:56
Cave Cr. @ Cactus Basin	4833	10.38	414	2/19 04:26
Centennial @ Wenden	5093	0.45	71	2/13 05:51
Centennial near Aguila	5178	0.32	11	2/12 05:59
Centennial Railroad	5103	3.26	258	2/11 16:39
Cline Creek	5583	0.59	12	2/12 01:26
Colter @ El Mirage	5408	0.47	25	2/19 13:18
Copper Wash	5033	0.69	16	2/19 23:00
Cruff Wash	5078	1.17	53	2/20 00:31
Delaney Wash	5108	2.90	364	2/20 00:39
Dysart @ El Mirage	5422	2.26	167	2/24 02:46
Dysart Drain @ LAFB	5413	0.60	22	2/24 03:37
E.Fork Cave Cr. near 7 th Ave.	4668	1.80	137	2/12 19:33
EMF @ Arizona Ave.	6598	1.43	616	2/19 13:29
EMF @ Broadway Rd.	6573	1.62	504	2/19 04:10

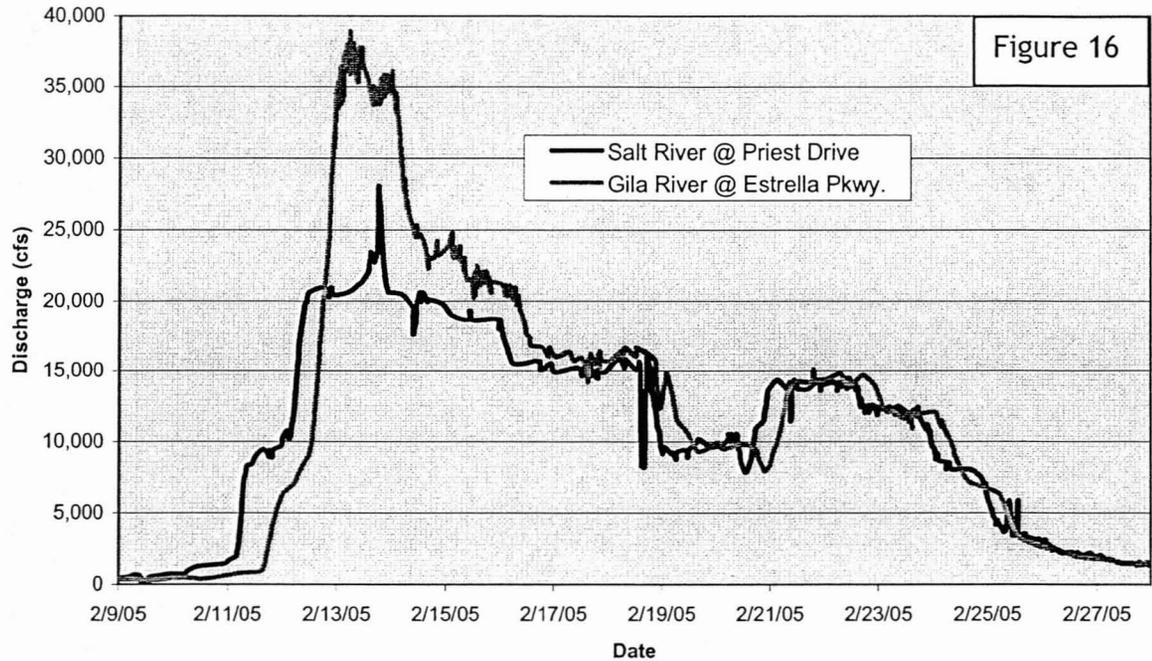
STATION	ID	PEAK STAGE (feet)	PEAK RUNOFF (cfs)	DATE - TIME
EMF @ Queen Creek Rd.	6583	2.95	1,554	2/19 08:30
Flying E Wash	7083	0.85	16	2/12 06:17
Gila @ Estrella Pkwy.	6853	14.00	38,900	2/13 05:18
Gila @ Olberg	0783	2.71	1,902	2/14 04:39
Gila @ 116 th Ave.	6848	9.15	49,394	2/13 02:17
Guadalupe Channel	6603	1.10	191	2/19 03:59
Hassy R. near Morristown	5223	14.05	14,962	2/12 09:49
Hassy R. @ Box Canyon	5308	15.50	15,791	2/12 09:28
Hassy R. @ I-10	5283	4.17	5,775	2/12 19:02
Hassy R. @ Wagoner Rd.	5352	5.62	497	2/12 04:08
IBW @ Indian Bend Rd.	4613	3.15	772	2/19 07:31
IBW @ Indian School Rd.	4618	2.90	422	2/19 07:52
IBW Interceptor	4623	0.60	37	2/19 07:17
IBW @ McDonald Dr.	4628	0.95	596	2/19 08:02
IBW @ McKellips Rd.	4603	2.15	591	2/19 10:19
IBW @ Shea Blvd.	4693	1.58	370	2/19 03:24
IBW @ Sweetwater Ave.	4643	1.65	216	2/12 18:41
Jackrabbit Wash	5218	3.45	1,134	2/11 19:21
Martinez Creek	7013	4.12	1,020	2/12 07:27
McDowell Mountain Rd.	5923	0.30	24	2/11 23:23
McMicken Floodway	5438	0.43	12	2/09 08:48
New River @ Bell Rd.	5598	2.05	1,430	2/12 18:01
New River @ Glendale Ave.	5508	1.48	873	2/12 13:13
New River Dam Outlet	5613	9.11	1,452	2/12 20:52
Old Crosscut @ McDowell Rd.	4748	1.08	172	2/19 01:30
Price Drain @ Loop 202	4573	5.01	311	2/11 21:58
Queen Creek @ CAP	6723	10.15	1,034	2/12 12:01
Queen Cr. @ Rittenhouse Rd.	6707	3.50	475	2/13 02:18
Rainbow Wash	6953	1.12	178	2/23 23:33
Reata Pass Wash	4588	0.53	63	2/19 01:24
Salt River @ Priest Dr.	4523	8.50	28,034	2/13 18:02
Scatter Wash	5543	1.62	472	2/12 17:52
Seven Springs Wash	4963	2.55	137	2/11 18:23
Skunk Cr. near New River	5588	1.14	102	2/18 00:57
Skunk Cr. @ I-17	5568	2.27	504	2/12 18:27
Tiger Wash	5163	7.40	1,822	2/12 05:01
Waterman Wash @ RVR	6833	2.67	169	2/24 04:45
Winters Wash	5118	0.69	29	2/20 01:04

Acronyms and Abbreviations used in Tables 1 & 2 above:

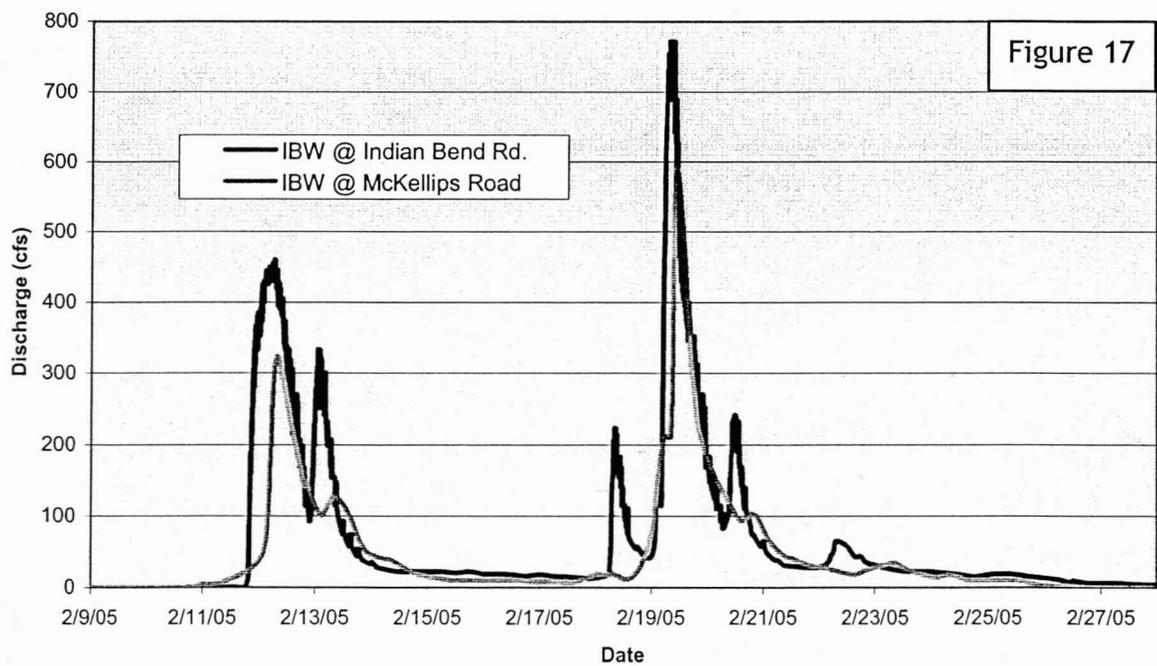
ACDC	Arizona Canal Diversion Channel
CAP	Central AZ Project Canal
EMF	East Maricopa Floodway
FRS	Flood Retarding Structure
G & F	AZ Game and Fish
Gila	Gila River
Hassy	Hassayampa River
IBW	Indian Bend Wash
LAFB	Luke Air Force Base
RVR	Rainbow Valley Road

SELECTED HYDROGRAPHS

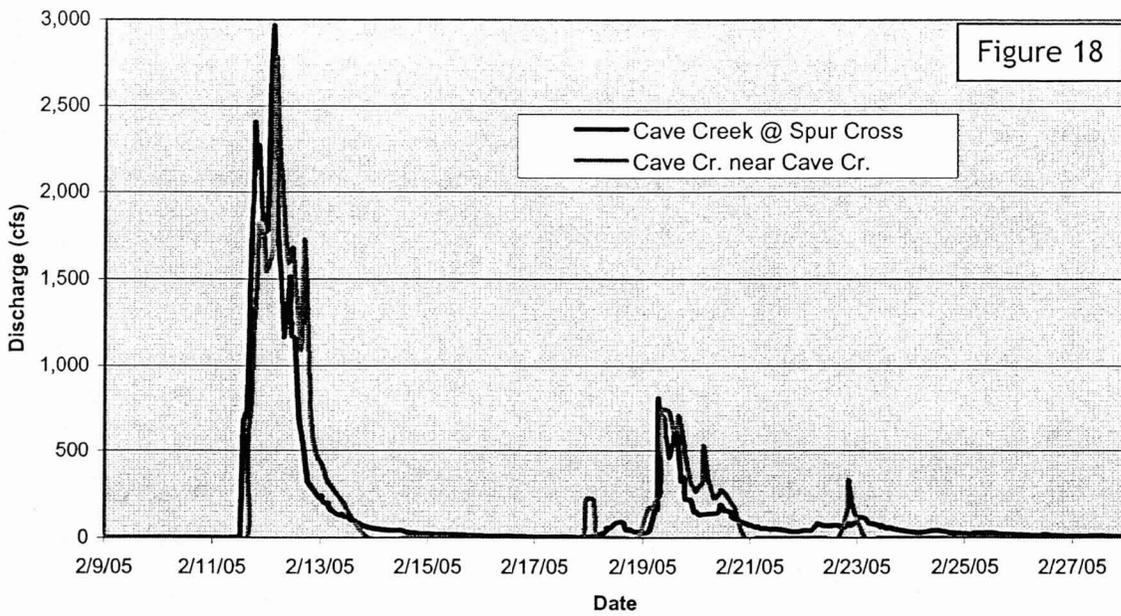
Measured Flows on the Salt/Gila System



Measured Flows along Indian Bend Wash



Measured Flows along Cave Creek



Stage Hydrograph at Rittenhouse FRS

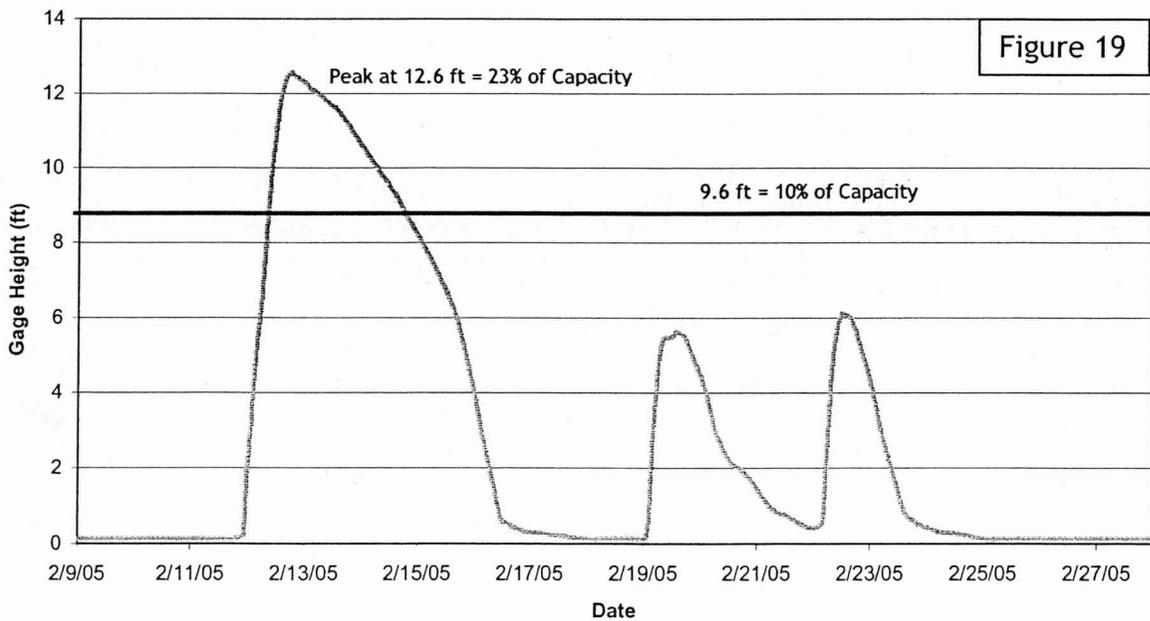


Figure 20 at right shows how the total US precipitation measured in February 2005 compares to previous years. Most of northern and eastern Arizona, which includes the Little Colorado, Gila, Salt, Verde, Agua Fria and Hassayampa watersheds ranks higher than 90% of previous years.

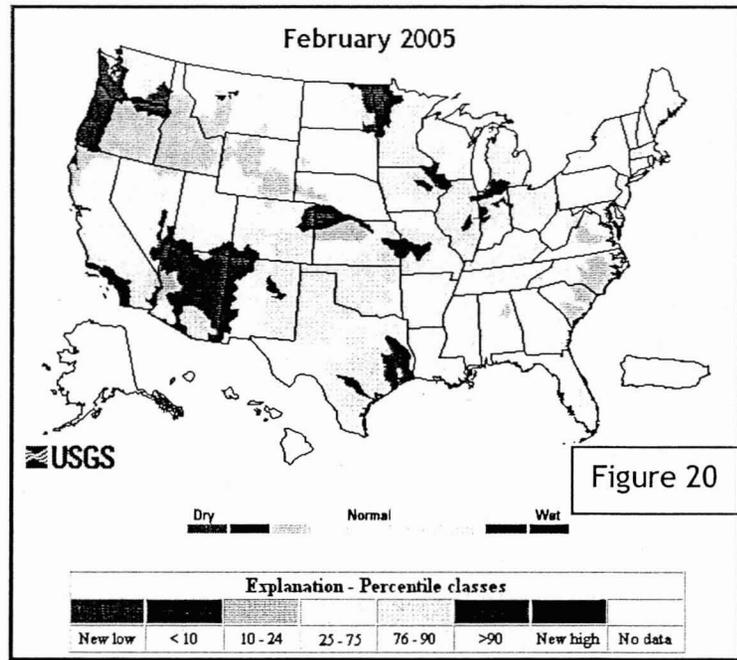
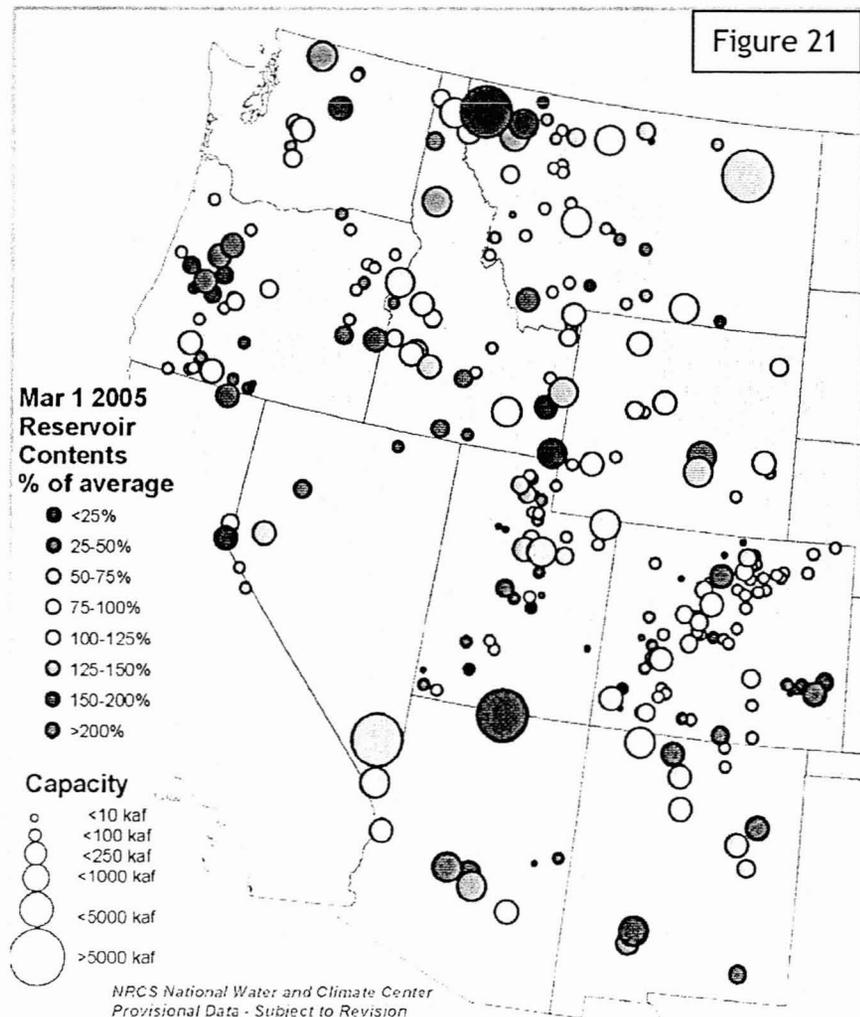


Figure 21 at right shows the rankings of reservoir levels as of 3/01/05 compared to their levels on the same date in previous years. Although it is not clear which dot represents which reservoir in central Arizona, it is clear that the purple, dark blue and blue dots represent greater than average storage levels. This was of course not the case at the beginning of water-year 2005.



FLOOD DAMAGE IN MARICOPA COUNTY

Flood control structures owned and operated by the Flood Control District did not sustain any significant damage during the flooding of February 2005. No ALERT monitoring stations sustained damage due to flooding, although one station was found to have a vandalized solar panel early in the month. It was replaced before the battery went dead.

The following is an excerpt from a 2/28/05 memo from Dennis Cvancara of Maricopa County Emergency Management to Steve Sipple of the National Weather Service:

This year's winter storm flood damage to Maricopa County was generally confined to the Wickenburg area; however, other damage was sustained in other parts of the County. The approach to the Alma School Bridge over the Salt River received substantial damage, forcing road restrictions for several weeks and incurring expensive repair bills. Seven deaths were reported in Arizona due to flooding. Three individuals from Maricopa County died as a result of flooding in Sycamore Creek in Gila County, but no deaths were reported in Maricopa County...

... The next major storm to strike Maricopa County occurred on Thursday, February 10th, when a powerful storm moved in again from the west. The National Weather Service, in anticipation of heavy runoff as warm rains melt(ed) snow in the high country, issued flash-flood watches and urban and small-stream flood warnings. The town of Wickenburg received 1.89 inches of rain swelling the Hassayampa River. The river washed away two mobile homes and two vehicles. Additionally, the Jack Burden Road was washed out and three utility poles were lost, resulting in power outages. Arizona Public Service reported 25 individuals were left without power which was restored the following Monday. Telephone, water and gas service was also restored that day. The Maricopa County Sheriff's Office was credited with rescuing 21 individuals in 11 incidents during the weekend ending February 13th as helicopter crews plucked individuals from vehicles stranded in various washes...

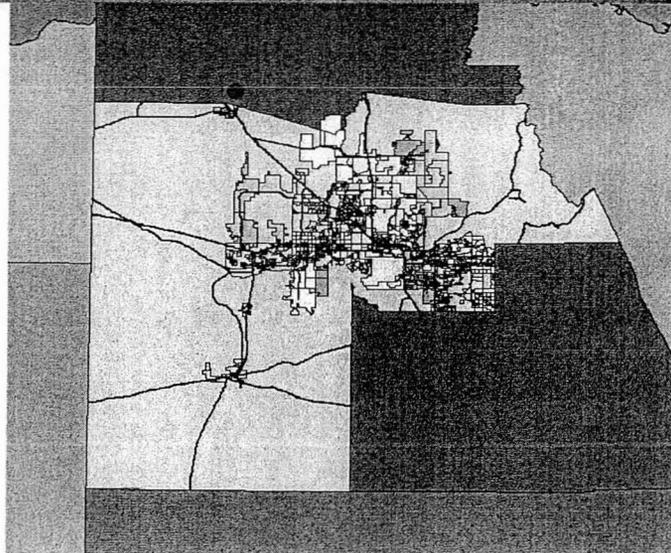
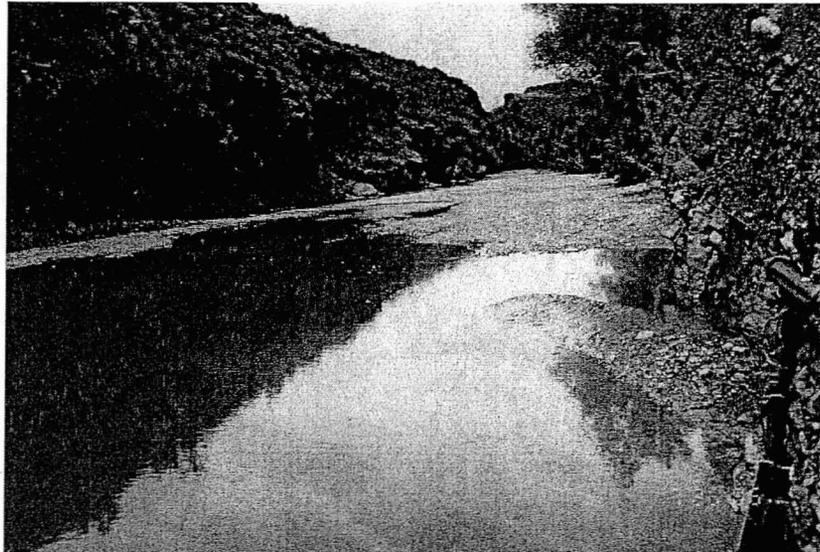
... In summary, the winter storms of late 2004 and early 2005 provided much needed moisture to the Valley and left the water reservoirs full or nearly full, including Roosevelt Lake. Unfortunately, Maricopa County suffered an estimated \$6.5 million in damage during this time period.



A.3 Gage Information (Hassayampa River and Sols Wash)

Hassayampa River at Box Canyon ID #: 5308

Thu Jun 16 09:10:00 MST 2005



GAGE ID HISTORY

ID	Elev of Instr. in GH	Elev of Instr. in NAVD 1988	Period
5308	3.15	Gage Height Datum	10/1/96 - present
5308	3.00	Gage Height Datum	12/12/95 - 9/30/96
5308	2.20	Gage Height Datum	1/19/93 - 12/12/95
5308	0.00	Gage Height Datum	8/18/92 - 1/19/93
3663	0.00	Gage Height Datum	10/1/91 - 8/18/92
0048	0.00	Gage Height Datum	11/17/83 - 9/30/91

SITE DATA

LOCATION	GAGE IS LOCATED NORTHEAST OF WICKENBURG IN YAVAPAI COUNTY, ABOUT 7 MILES ON SCENIC LOOP ROAD FROM US 93
DRAINAGE AREA	417 MI²
JURISDICTION	YAVAPAI COUNTY, ARIZONA
WATERSHED	LOWER HASSAYAMPA
SECTION/TOWNSHIP/RANGE	SW1/4 SE1/4 S07 T8N R4W
LATITUDE	N 33 58 11
LONGITUDE	W 112 43 38
USGS QUAD MAP	SAM POWELL PEAK 7.5-MINUTE
STREAMGAGE INSTALLATION DATE	NOVEMBER 17, 1983 (WY 1984)
PERIOD OF AVAILABLE DATA RECORD	OCTOBER 16, 1991 - CURRENT YEAR
LENGTH OF AVAILABLE RECORD (AS OF 10/01/04)	12.96 YEARS
QUALITY OF AVAILABLE RECORD	GOOD

STAGE GAGE TYPE	PRESSURE TRANSDUCER		
STAFF GAGE	ONE, INSIDE STILLING WELL		
CREST STAGE GAGE	TWO		
ZERO GAGE HEIGHT ELEVATION	GAGE HEIGHT DATUM		
STAGE GAGE ELEVATION	3.15 FEET GAGE HEIGHT		
POINT OF ZERO FLOW	1.9 FEET GAGE HEIGHT (SEPT 2004)		
MAXIMUM FLOOD	58,000 CFS	34.6 FEET G.H.	SEPTEMBER 5, 1970

RATING INFORMATION

RATING TABLE			
<i>CURRENT RATING NUMBER 7, DATED OCTOBER 1, 2001</i>			
GAGE HEIGHT (FEET)	DISCHARGE (CFS)	GAGE HEIGHT (FEET)	DISCHARGE (CFS)
0.00	0	12.23	10,000
3.16	19	17.63	20,000
4.10	200	22.60	30,000
5.55	1,000	27.00	40,000
9.30	5,000	31.10	50,000

WATER YEAR PEAKS

Water Year	Peak Gage Height (feet)	Peak Discharge (cfs)	Date of Peak
2005			
2004	6.10	1,423	9/19/04
2003	4.72	467	2/13/03
2002	5.50	950	9/7/02
2001	7.20	3,215	10/27/00
2000	4.33	636	8/29/00
1999	9.20	5,650	8/31/99
1998	5.22	1,254	3/29/98
1997	8.35	3,549	9/26/97
1996	11.25	7,548	7/25/96
1995	14.60	13,016	2/15/95
1994	4.35	175	9/3/94
1993	21.30	25,748	1/8/93
1992	6.00	2,829	2/13/92
1991	Data Unavailable	Data Unavailable	Data Unavailable
1990	Data Unavailable	Data Unavailable	Data Unavailable
1989	Data Unavailable	Data Unavailable	Data Unavailable
1988	Data Unavailable	Data Unavailable	Data Unavailable
1987	Data Unavailable	Data Unavailable	Data Unavailable
1986	Data Unavailable	Data Unavailable	Data Unavailable
1985	Data Unavailable	Data Unavailable	Data Unavailable
1984	Data Unavailable	Data Unavailable	Data Unavailable

RUNOFF EVENT HISTORY (>250 cfs)

Date of Peak	Time of Peak	Runoff Period	Duration (hours)	Peak Stage feet G.H.	Peak Discharge (cfs)	Water Year
		<u>SELECT FOR A PLOT OF THESE DATA</u>				
9/19/04	18:11	09/19 17:51 - 09/20 03:18	9.4	6.10	1,423	2004
8/17/04		Data Unavailable		5.50	963	2004
2/26/03	14:13	02/26 01:39 - 03/01 18:15	88.6	4.65	426	2003
2/13/03	23:06	02/13 22:41 - 02/14 23:17	24.6	4.72	467	2003
9/11/02	04:16	09/11 01:27 - 09/11 11:25	10.0	5.05	662	2002
9/7/02	20:52	09/07 19:15 - 09/08 09:31	14.3	5.50	950	2002
9/15/01	22:58	09/15 22:46 - 09/16 03:50	5.1	3.48	288	2001
3/10/01	13:59	03/08 16:02 - 03/12 23:12	103.2	3.38	274	2001
3/7/01	15:50	03/07 11:07 - 03/08 02:47	15.7	4.38	667	2001
10/27/00	19:42	10/27 12:44 - 10/28 07:40	18.9	7.20	3,215	2001
10/21/00	21:19	10/21 21:42 - 10/22 17:20	19.5	4.93	1,019	2001
8/29/00	12:47	08/29 10:30 - 08/29 23:04	12.6	4.33	636	2000
3/6/00	10:57	03/06 08:35 - 03/06 15:26	6.9	3.58	298	2000

9/23/99	17:45	09/23 16:03 - 09/24 11:21	19.3	7.58	3,630	1999
9/19/99	23:39	09/19 23:19 - 09/20 10:33	11.2	4.30	621	1999
9/15/99	03:16	09/15 03:10 - 09/15 08:37	5.5	3.65	322	1999
9/11/99	22:42	09/11 20:57 - 09/12 02:26	5.5	4.15	530	1999
8/31/99	17:46	08/31 16:20 - 09/01 05:40	13.3	9.20	5,650	1999
7/29/99	16:46	07/29 14:16 - 07/30 00:18	10.0	3.88	416	1999
7/26/99	01:40	07/25 20:21 - 07/26 04:29	8.1	4.25	590	1999
7/15/99	10:30	07/15 10:07 - 07/15 15:38	5.5	4.20	560	1999
4/13/98	04:17	Continual 02/04 - 04/17		3.85	406	1998
4/7/98	15:16	Continual 02/04 - 04/17		3.75	365	1998
4/2/98	08:53	Continual 02/04 - 04/17		4.03	473	1998
3/29/98	02:19	Continual 02/04 - 04/17		5.22	1,254	1998
2/25/98	02:51	Continual 02/04 - 04/17		4.40	314	1998
2/15/98	09:03	Continual 02/04 - 04/17		4.93	583	1998
2/9/98	13:30	Continual 02/04 - 04/17		4.55	378	1998
9/26/97	09:21	09/26 03:29 - 09/27 07:31	28.0	8.35	3,549	1997
2/28/97	06:45	02/28 05:20 - 03/15 02:03	356.7	5.25	453	1997

1/14/97	02:00	01/13 17:05 - 01/21 23:56	198.9	5.50	525	1997
9/5/96	14:11	09/05 14:10 - 09/08 23:27	81.3	5.53	256	1996
7/25/96	22:43	07/25 22:16 - 07/26 05:17	7.0	11.25	7,548	1996
3/11/95	23:51	03/11 18:30 - 04/10 23:12	724.7	5.60	596	1995
3/6/95	10:14	03/06 02:13 - 03/06 19:45	17.5	10.88	6,974	1995
3/1/95	15:50	03/01 03:39 - undefined		4.75	271	1995
2/24/95	04:38	02/24 03:32 - 02/24 20:07	16.6	5.05	360	1995
<u>2/15/95</u>	03:13	02/14 16:13 - 02/15 20:40	28.5	14.60	13,016	1995
1/26/95	17:08	01/25 13:53 - 01/28 04:51	63.0	6.25	1,103	1995
1/5/95	06:46	01/05 05:40 - 01/08 08:34	74.9	6.60	1,414	1995
3/15/93	10:43	Continual 01/19 - 04/10		5.00	344	1993
3/12/93	12:49	Continual 01/19 - 04/10		5.20	410	1993
3/10/93	10:45	Continual 01/19 - 04/10		5.30	446	1993
3/2/93	13:21	Continual 01/19 - 04/10		5.50	535	1993
2/22/93	10:17	Continual 01/19 - 04/10		5.90	810	1993
<u>2/20/93</u>	06:13	02/17 12:04 - 02/21 02:36	86.5	16.00	15,451	1993
2/14/93	10:53	Continual 01/19 - 04/10		6.30	1,144	1993

2/8/93	23:52	02/08 04:56 - 02/10 01:21	44.4	13.50	11,215	1993
1/29/93	22:37	Continual 01/19 - 04/10		5.80	734	1993
1/25/93	18:59	Continual 01/19 - 04/10		7.30	2,170	1993
1/8/93		Data Unavailable		21.3	25,748	1993
7/24/92	14:14	07/24 11:56 - 07/25 06:26	18.5	1.80	280	1992
4/2/92	13:40	04/02 10:16 - 04/03 00:57	14.7	2.00	347	1992
3/9/92	08:19	03/08 10:42 - 03/09 21:10	34.5	2.70	644	1992
2/13/92	16:32	02/13 15:04 - 02/14 10:11	19.1	6.00	2,829	1992
2/7/92	19:26	02/07 19:12 - 02/08 02:43	7.5	2.10	382	1992

FLOOD FLOW FREQUENCY

<u>Flood Flow Frequency</u>					
(based on HECWRC implementation of Bulletin 17B, n = 54)					
Magnitude and Probability of Instantaneous Peak Flow					
Discharge, in cfs, for Indicated Recurrence Interval					
2-year	5-year	10-year	20-year	50-year	100-year
3,410	10,300	18,200	28,800	47,900	66,800

CREST STAGE GAGE INFORMATION

CREST GAGE NUMBER	PIN ELEVATION (FEET, GAGE HEIGHT)	CREST GAGE NUMBER	PIN ELEVATION (FEET, GAGE HEIGHT)
1	3.12	2	13.04

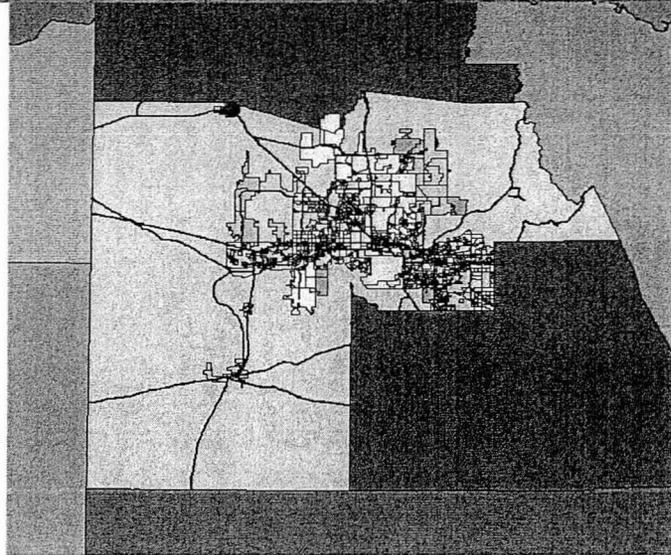
STAFF GAGE INFORMATION

STAFF GAGE RANGE	LOW POINT	STAFF GAGE INFORMATION
0 - 20 FEET	0.00	INSIDE STILLING WELL, READ IN GAGE HEIGHT

Hassayampa River at US 60 ID #: 5228

Thu Jun 16 09:20:27 MST 2005

Hassayampa River at US60
Aug. 29, 2000, 13:30



GAGE ID HISTORY

ID	Elev of Instr. in GH	Elev of Instr. in M.S.L.	Period
5228	1.59	2,034.07	4/15/02 - present
5228	0.00	2,032.60	3/14/94 - 4/15/02

SITE DATA

LOCATION	LOCATED ON THE US 60 BRIDGE CROSSING IN WICKENBURG		
DRAINAGE AREA	711 MI²		
JURISDICTION	WICKENBURG, ARIZONA		
WATERSHED	LOWER HASSAYAMPA		
SECTION/TOWNSHIP/RANGE	SW1/4 SW1/4 SE1/4 S01 T7N R5W		
LATITUDE	N 33 58 14		
LONGITUDE	W 112 43 31		
USGS QUAD MAP	WICKENBURG 7.5-MINUTE		
STREAMGAGE INSTALLATION DATE	MARCH 14, 1994 (WY 1994)		
PERIOD OF AVAILABLE DATA RECORD	MARCH 14, 1994 - CURRENT YEAR		
LENGTH OF AVAILABLE RECORD (AS OF 10/1/04)	10.55 YEARS		
QUALITY OF AVAILABLE DATA RECORD	GOOD		
STAGE GAGE TYPE	PRESSURE TRANSDUCER		
STAFF GAGE	ONE		
CREST STAGE GAGE	TWO		
ZERO GAGE HEIGHT ELEVATION	2,032.60 FEET M.S.L.		
STAGE GAGE ELEVATION	1.47 FEET GAGE HEIGHT		
POINT OF ZERO FLOW	0.2 FEET GAGE HEIGHT (AUG. 2004)		
MAXIMUM FLOOD	52,000 CFS	10.3 FEET G.H.	SEPT. 5, 1970

RATING INFORMATION

RATING TABLE			
<i>CURRENT RATING NUMBER 6, DATED OCTOBER 1, 2000</i>			
GAGE HEIGHT (FEET)	DISCHARGE (CFS)	GAGE HEIGHT (FEET)	DISCHARGE (CFS)
0.0	0	6.0	21,400
0.5	39	7.0	30,000
1.0	216	8.0	40,270
1.5	610	9.0	50,732
3.0	2,700	10.0	60,000
4.0	5,750		

WATER YEAR PEAKS

Water Year	Peak Gage Height (ft)	Peak Discharge (cfs)	Date of Peak
2005			
2004	1.66	770	8/17/04
2003	1.87	993	8/14/03
2002	1.59	0	---
2001	4.90	11,100	10/21/00
2000	1.70	1,668	8/29/00
1999	0.88	3,363	8/31/99
1998	0.00	0	---
1997	3.88	15,376	9/26/97
1996	2.40	4,923	7/25/96
1995	3.12	8,109	2/15/95
1994	0.22	611	9/3/94

RUNOFF EVENT HISTORY

Date of Peak	Time of Peak	Runoff Period	Duration (hours)	Peak Stage feet G.H.	Peak Discharge (cfs)	Water Year
8/17/04		Data Unavailable		1.66	770	2004
9/4/03	21:31	09/04 21:29 - 09/06 19:07	45.6	8.93	1,092	2003
8/14/03	23:18	08/14 23:18 - 08/15 00:23	1.1	1.75	857	2003
2/14/03	02:31	02/14 02:31 (single report)	0.0	1.66	740	2003
10/27/00	14:57	10/26 10:36 - 10/29 10:57	72.3	3.62	4,439	2001
10/21/00	22:21	10/21 10:56 - 10/24 04:22	65.4	4.90	11,100	2001
8/29/00	12:47	08/29 12:02 - 08/29 14:57	2.9	1.70	2,030	2000
8/31/99	18:53	08/31 18:44 - 08/31 23:24	4.7	0.88	3,363	1999
<u>9/26/97</u>	05:25	09/26 00:10 - 09/26 13:13	13.0	3.88	15,376	1997
7/25/96	23:54	07/25 23:42 - 07/26 01:15	1.5	2.40	4,923	1996
3/6/95	10:47	03/06 04:05 - 03/07 23:36	43.5	2.28	4,257	1995
2/15/95	03:31	02/14 20:14 - 02/16 04:19	32.1	3.12	8,109	1995
1/26/95	08:09	01/25 18:12 - 01/28 06:20	60.1	1.38	1,070	1995
1/5/95	08:17	01/05 07:36 - 01/06 17:09	25.6	1.48	1,329	1995
9/3/94	10:47	09/03 08:03 - 09/03 11:36	3.5	0.22	611	1994

FLOOD FLOW FREQUENCY

<u>Flood Flow Frequency</u>					
(based on HECWRC implementation of Bulletin 17B, n = 11)					
Magnitude and Probability of Instantaneous Peak Flow					
Discharge, in cfs, for Indicated Recurrence Interval					
2-year	5-year	10-year	20-year	50-year	100-year
2,130	6,660	11,800	18,800	31,400	43,800

CREST STAGE GAGE INFORMATION

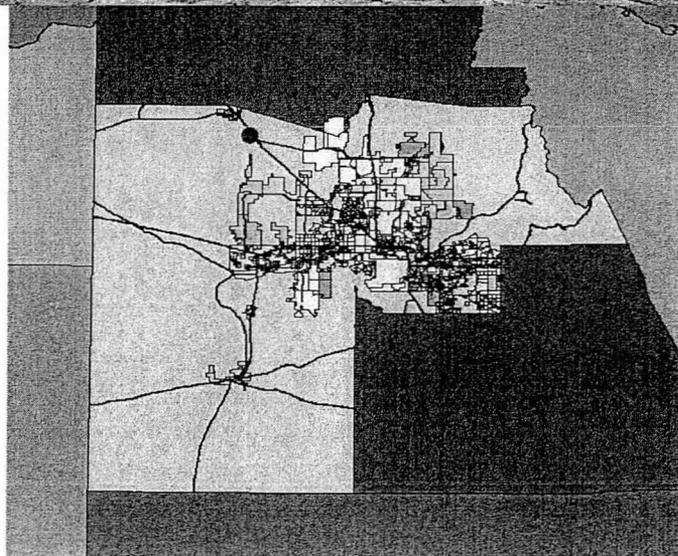
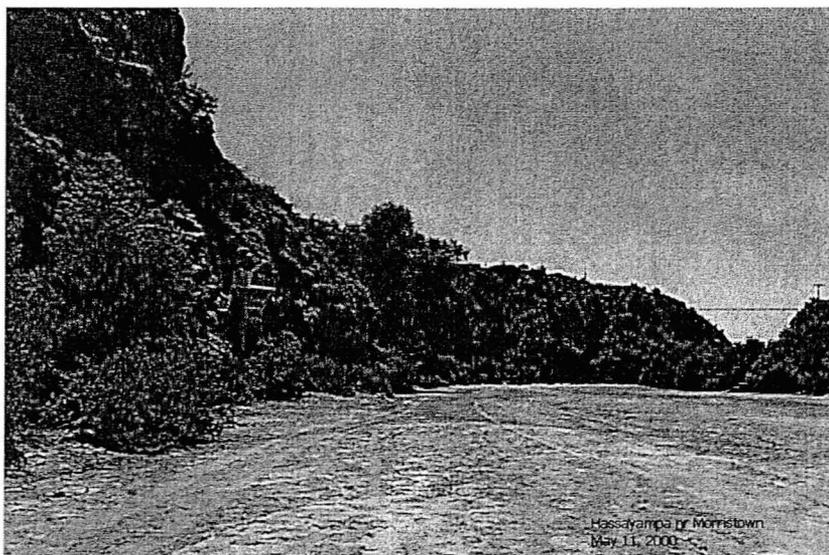
CREST GAGE NUMBER	PIN ELEVATION (FEET, GAGE HEIGHT)	CREST GAGE INFORMATION
1	1.52	LOCATED NEAR PT GAGE
2	5.71	LOCATED NEAR PT GAGE

STAFF GAGE INFORMATION

STAFF GAGE RANGE	LOW POINT	STAFF GAGE INFORMATION
0 - 10	0.0	READS IN G.H. READ FROM RIGHT BANK

Hassayampa River near Morristown ID #: 5223

Thu Jun 16 09:31:47 MST 2005



GAGE ID HISTORY

ID	Elev of Instr. in GH	Elev of Instr. in M.S.L.	Period
5223	7.25	USGS Gage Datum	10/1/03 - present
5223	7.00	USGS Gage Datum	5/7/96 - 10/1/03

SITE DATA

LOCATION	GAGE IS LOCATED ABOUT 6 MILES SOUTH OF WICKENBURG AND JUST DOWNSTREAM OF SAN DOMINGO WASH ON US60		
DRAINAGE AREA	796 MI²		
JURISDICTION	MARICOPA COUNTY, ARIZONA		
WATERSHED	LOWER HASSAYAMPA		
SECTION/TOWNSHIP/RANGE	SW1/4 SE1/4 S03 T6N R4W		
LATITUDE	N 33 53 06		
LONGITUDE	W 112 39 41		
USGS QUAD MAP	WICKENBURG 7.5-MINUTE		
FCDMC STREAMGAGE INSTALLATION DATE	MAY 7, 1996 (WY 1996)		
PERIOD OF AVAILABLE DATA RECORD	MAY 7, 1996 - CURRENT YEAR		
LENGTH OF AVAILABLE RECORD (AS OF 10/1/04)	7.40 YEARS (FCD GAGE)		
QUALITY OF AVAILABLE RECORD	GOOD		
STAGE GAGE TYPE	PRESSURE TRANSDUCER		
STAFF GAGE	TWO		
CREST STAGE GAGE	NONE		
ZERO GAGE HEIGHT ELEVATION	GAGE HEIGHT DATUM		
STAGE GAGE ELEVATION	7.00 FEET GAGE HEIGHT		
POINT OF ZERO FLOW	8.00 FEET GAGE HEIGHT, APPROXIMATE		
PEAK DISCHARGE	47,500 CFS		SEPT. 5, 1970

ESTIMATED TRAVEL TIMES

TO PATTON ROAD, ABOUT 11.2 MILES DOWNSTREAM		
DISCHARGE (CFS)	GAGE HEIGHT (FEET)	TIME (HOURS)
500	8.32	7.8
1,000	8.85	5.9
5,000	11.0	2.8
10,000	12.6	2.5

RATING INFORMATION

RATING TABLE			
CURRENT RATING NUMBER 6 APPLIED AS OF MAY 7, 1996			
GAGE HEIGHT (FEET)	DISCHARGE (CFS)	GAGE HEIGHT (FEET)	DISCHARGE (CFS)
7.0	0	12.0	7,903
8.0	281	14.0	15,890
9.0	1,183	16.0	26,750
10.0	2,731	18.0	40,560
11.0	4,980	19.4	52,000

WATER YEAR PEAKS

Water Year	Peak Gage Height (feet)	Peak Discharge (cfs)	Date of Peak
2005			
2004	---	0	NONE
2003	9.57	1,990	2/13/03
2002	8.68	816	9/7/02
2001	11.73	7,029	10/27/00
2000	9.10	1,308	8/29/00
1999	9.82	2,411	7/25/99
1998	8.52	670	6/3/98
1997	12.35	9,095	9/26/97
1996	9.45	1,796	7/26/96

Additional data may be available from the USGS for this site. The USGS has operated this site somewhat continuously since 1938.

RUNOFF EVENT HISTORY

Date of Peak	Time of Peak	Runoff Period	Duration (hours)	Peak Stage feet G.H.	Peak Discharge (cfs)	Water Year
9/4/03	21:31	09/04 21:29 - 09/06 19:07	45.6	8.93	1,092	2003
8/26/03	23:49	08/26 23:09 - 08/27 11:58	12.8	8.98	1,152	2003
8/15/03	02:02	08/15 01:56 - 08/15 13:38	11.7	9.12	1,340	2003
2/13/03	20:00	02/13 19:47 - 02/14 19:17	23.5	9.57	1,990	2003
9/7/02	19:11	09/07 18:32 - 09/07 20:54	2.4	8.68	816	2002
10/27/00	15:11	10/27 12:51 - 10/28 15:21	26.5	11.73	7,029	2001
10/21/00	23:21	10/21 21:55 - 10/22 03:20	5.4	11.10	5,241	2001
8/29/00	13:50	08/29 12:03 - 08/30 08:24	20.4	9.10	1,308	2000
9/23/99	19:54	09/23 19:49 - 09/24 06:01	10.2	8.60	741	1999
8/31/99	19:22	08/31 19:17 - 08/31 21:39	2.4	9.23	1,473	1999
7/29/99	11:54	07/29 10:54 - 07/29 15:51	5.0	8.55	693	1999
7/25/99	23:57	07/25 23:41 - 07/26 14:18	14.6	9.82	2,411	1999
8/12/98	19:43	08/12 18:53 - 08/13 05:43	10.8	8.15	375	1998
8/8/98	00:14	08/07 23:24 - 08/08 03:45	4.4	8.23	427	1998

6/3/98		Continuous 12/7/97 - 6/22/98		8.52	670	1998
5/14/98		Continuous 12/7/97 - 6/22/98		8.10	342	1998
5/5/98		Continuous 12/7/97 - 6/22/98		8.10	342	1998
4/13/98		Continuous 12/7/97 - 6/22/98		8.00	281	1998
3/29/98		Continuous 12/7/97 - 6/22/98		8.43	582	1998
2/15/98		Continuous 12/7/97 - 6/22/98		8.02	296	1998
2/9/98		Continuous 12/7/97 - 6/22/98		8.05	311	1998
<u>9/26/97</u>	06:38	09/26 06:09 - 09/27 01:44	19.6	12.35	9,095	1997
9/11/96	01:28	09/10 23:01 - 09/11 05:06	6.1	8.12	358	1997
7/26/96	01:31	07/26 01:29 - 07/26 10:32	9.1	9.45	1,796	1996

FLOOD FLOW FREQUENCY

<u>Flood Flow Frequency</u>					
(based on period of record 1939-47, 1964-81, and 1983-2004, n=51)					
Magnitude and Probability of Instantaneous Peak Flow					
Discharge, in cfs, for Indicated Recurrence Interval					
2-year	5-year	10-year	25-year	50-year	100-year
2,810	10,000	17,800	27,200	42,000	54,600

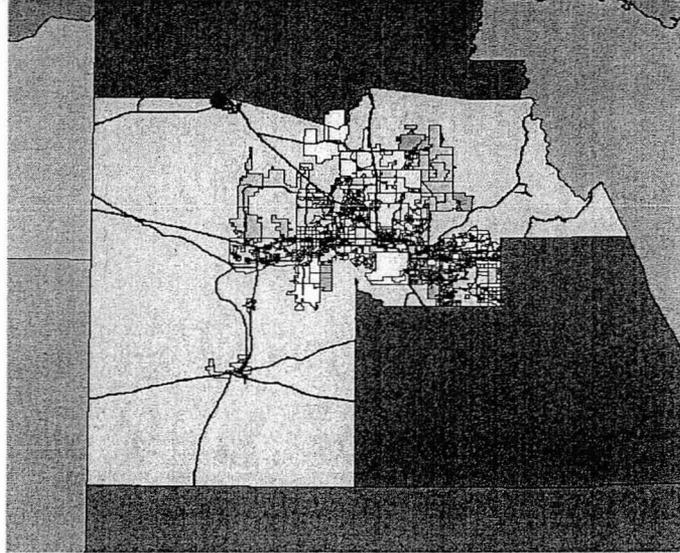
CREST STAGE GAGE INFORMATION

CREST GAGE NUMBER	PIN ELEVATION (FEET, GAGE HEIGHT)	CREST GAGE NUMBER	PIN ELEVATION (FEET, GAGE HEIGHT)

STAFF GAGE INFORMATION

STAFF GAGE RANGE	LOW POINT	STAFF GAGE INFORMATION
0.00 - 23.70 FEET	0.00	INSIDE OF STILLING WELL, READS IN GAGE HEIGHT
0.00 - 23.70 FEET	0.00	OUTSIDE OF STILLING WELL, READS IN GAGE HEIGHT

Tue Jun 14 09:59:05 MST 2005



GAGE ID HISTORY

ID	Elev of Instr. in GH	Elev of Instr. in NAVD 1988	Period
7043	0.36	2,230.99	10/1/01 - present
7043	0.48	2,231.11	4/26/01 - 9/30/01
7043	0.00	2,229.65	8/4/95 - 4/26/01

SITE DATA

LOCATION	GAGE IS LOCATED IN WICKENBURG APPROXIMATELY ONE MILE WEST OF VULTURE MINE ROAD		
DRAINAGE AREA	121.4 MI²		
JURISDICTION	WICKENBURG, ARIZONA		
WATERSHED	LOWER HASSAYAMPA		
SECTION/TOWNSHIP/RANGE	SE1/4 SE1/4 S32 T8N R5W		
LATITUDE	N 33 59 14		
LONGITUDE	W 112 47 36		
USGS QUAD MAP	VULTURE PEAK 7.5-MINUTE		
INSTALLATION DATE	AUGUST 4, 1995 (WY 1995)		
PERIOD OF AVAILABLE DATA RECORD	AUGUST 4, 1995 - CURRENT YEAR		
LENGTH OF AVAILABLE RECORD (AS OF 10/01/04)	9.16 YEARS		
QUALITY OF AVAILABLE RECORD	GOOD		
STAGE GAGE TYPE	NON-SUBMERSIBLE PRESSURE TRANSDUCER		
STAFF GAGE	NONE		
CREST STAGE GAGE	TWO		
ZERO GAGE HEIGHT ELEVATION	2,230.63 FEET NAVD 1988		
STAGE GAGE ELEVATION	0.36 FEET GAGE HEIGHT		
POINT OF ZERO FLOW	-0.20 FEET GAGE HEIGHT (MAY 7, 2001)		
MAXIMUM FLOOD	10,792 CFS	5.15 FEET G. H.	OCTOBER 21, 2000

RATING INFORMATION

RATING TABLE			
<i>CURRENT RATING: NUMBER 3.1, DATED OCTOBER 1, 2001</i>			
GAGE HEIGHT (FEET)	DISCHARGE (CFS)	GAGE HEIGHT (FEET)	DISCHARGE (CFS)
0.0	0	3.0	2,000
1.0	220	3.5	3,000
1.3	300	4.4	5,240
1.8	565	5.25	7,600
2.6	1,266	6.16	10,830

WATER YEAR PEAKS

Water Year	Peak Gage Height (feet)	Peak Discharge (cfs)	Date of Peak
2005			
2004	---	0	---
2003	2.68	1,400	8/14/03
2002	1.26	289	9/7/02
2001	5.15	10,792	10/21/00
2000	3.40	5,240	8/29/00
1999	0.80	528	7/18/99
1998	0.28	299	8/12/98
1997	4.70	7,978	9/26/97
1996	0.70	119	7/27/96
1995	---	0	---

RUNOFF EVENT HISTORY

Event Date	Time of Peak	Runoff Period	Duration (hours)	Peak Stage feet G.H.	Peak Discharge (cfs)	Water Year
9/4/03	19:18	09/04 18:28 - 09/04 21:08	2.7	2.49	1,146	2003
8/14/03	23:13	08/14 22:33 - 08/15 02:53	4.5	2.68	1,400	2003
8/13/03	22:02	08/13 21:57 - 08/13 22:17	0.3	0.71	132	2003
2/14/03	04:02	02/14 03:27 - 02/14 06:37	3.2	1.13	256	2003
9/7/02	12:22	09/07 12:02 - 09/07 14:07	2.1	1.26	289	2002
10/28/00	02:23	10/28 02:23 - 10/28 10:05	0.3	0.62	531	2001
<u>10/27/00</u>	14:23	10/27 12:17 - 10/28 00:24	12.1	3.22	4,772	2001
<u>10/21/00</u>	21:22	10/21 20:56 - 10/23 17:35	44.7	5.15	10,792	2001
10/21/00	20:07	10/21 20:07 - 10/21 20:17	0.2	1.25	995	2001
<u>8/29/00</u>	14:53	08/29 09:05 - 08/29 19:03	10.0	3.40	5,240	2000
8/27/00	07:08	08/27 07:03 - 08/27 08:53	1.8	0.80	565	2000
7/18/99	22:29	07/18 22:22 - 07/19 05:44	7.4	0.80	528	1999
7/15/99	06:08	07/15 06:07 - 07/15 09:09	3.0	0.65	468	1999
8/12/98	18:38	08/12 18:02 - 08/12 19:00	1.0	0.28	299	1998
<u>9/26/97</u>	04:14	09/25 17:48 - 09/26 11:19	17.5	4.70	7,978	1997

FLOOD FLOW FREQUENCY

<u>Flood Flow Frequency</u> (FEMA Sept. 1995)		
Magnitude and Probability of Instantaneous Peak Flow		
Discharge, in cfs, for indicated Recurrence Interval		
10-year	50-year	100-year
4,800	9,800	12,250

CREST STAGE GAGE INFORMATION

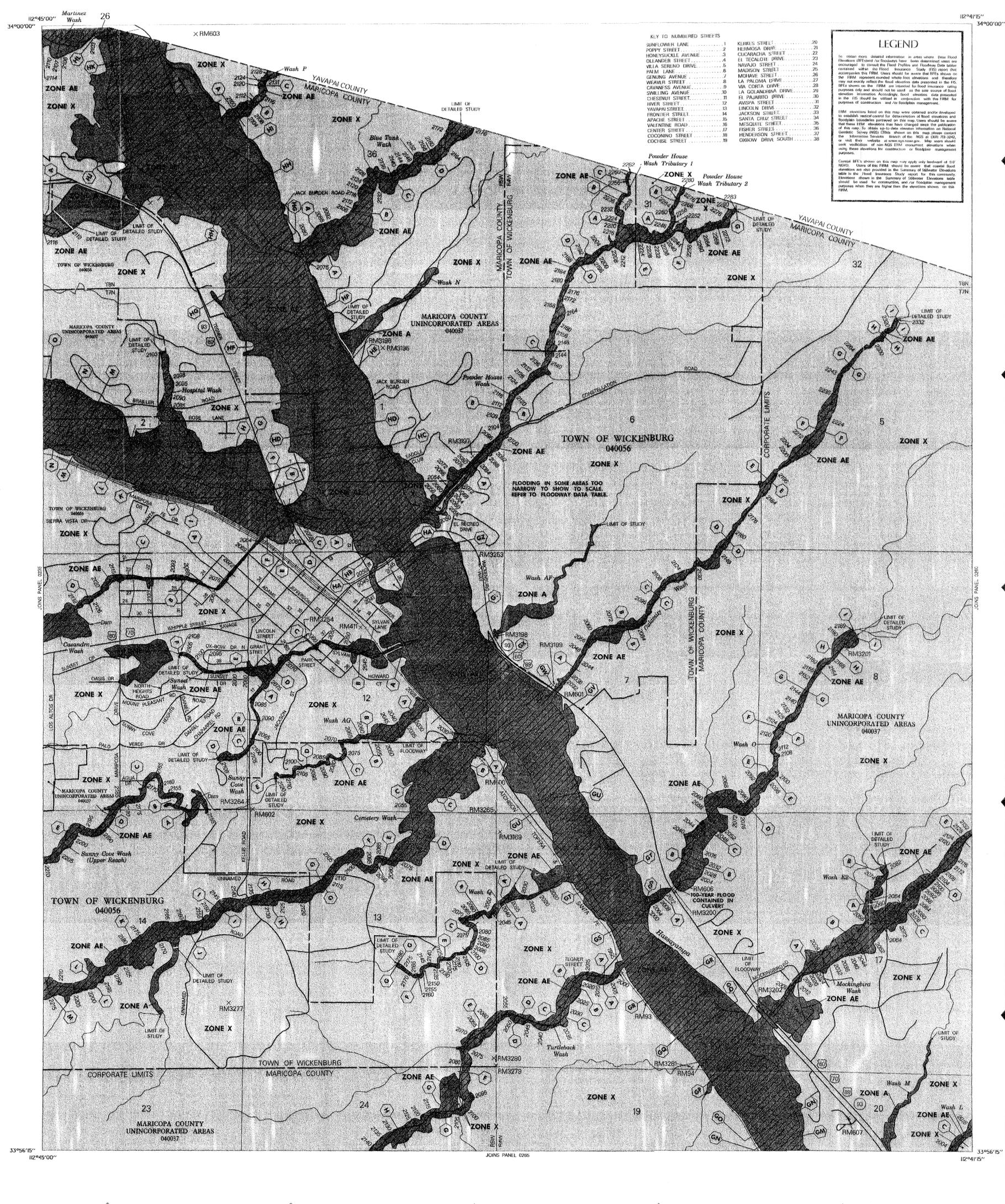
CREST GAGE NUMBER	PIN ELEVATION (FEET, GAGE HEIGHT)	CREST GAGE INFORMATION
1	2.84	AT RIGHT BANK
2	0.82	NEAR LEFT BANK



A.4 FEMA FIRM Panel

REFERENCE ELEVATION (FEET NGVD) DESCRIPTION OF LOCATION

- RM93 1993.78 U.S. Geological Survey standard disk 2.4 miles southeast of Wickenburg, approximately 100 feet west of the Atchison, Topeka and Santa Fe Railroad, marked M 24 1.933.
- RM94 1989.28 Metal-metal rivet in centerline of headwall on south side of Atchison, Topeka and Santa Fe Railroad, 2.5 miles southeast of Wickenburg, U.S. Geological Survey designation RV 118.
- RM411 2059.80 At Wickenburg, 0.4 mile south of the Atchison, Topeka and Santa Fe Railroad station, 55 feet west of centerline of track, in the corner of a concrete yard, a standard disk stamped N 24 1,933 and set in the top of a concrete post.
- RM600 2036.18 Chiseled 2- by 2-inch + on southeast corner of railroad bridge at Cemetery Wash.
- RM601 2034.84 Chiseled 2- by 2-inch + on top of 2- by 1-foot concrete headwall on the northwest corner of Calamity Wash bridge on State Route 93, approximately 0.4 mile north of mile post 112.
- RM602 2160.67 Chiseled X on top of north end of curb at the northeast corner of cattle guard on Kallis Road across the intersection of Kallis Road and Whipple Street in Wickenburg.
- RM603 2142.71 Brass cap set in a rock, stamped U.S. Coast and Geodetic Survey, HAS 1274, approximately 2 miles north of Wickenburg, 600 feet east of the east bank of the Hassayampa River, in a triangular station on station 2141 on the U.S. Department of Interior Geological Survey, Wickenburg Quadrangle.
- RM604 2094.75 Brass cap stamped A.D.O.T., ELEV. 2095.34 STA. 910 + 46.66 1963, set in top of 1- by 2- foot headwall on the west side of Highway 89 approximately 300 feet south of Kinross Road, Wickenburg.
- RM605 2053.02 Chiseled 2- by 2-inch + on southwest corner of concrete slab at top of transition of a ramp to the northeast corner of three key storage shelters, oriented in a north-south direction, of Double Brookhollowed Farm, Inc., located at the intersection of the east end of Conover and Weaver Streets in Wickenburg.
- RM606 2011.16 Brass cap stamped A.D.O.T., Sta. 938 + 88, ELEV. 2011.47 1957, on top of 7- by 5- foot-high box culvert on the east side of Route 93, where Turiloback Wash crosses under the highway, 0.25 mile north of north end of a median and 4.5 miles north of mile post 113, brass cap is approximately 15 feet below highway elevation.
- RM607 2012.02 Brass cap stamped Arizona Highway Department, STA. ELEV. set on by 10.5- by 2-foot-high headwall at north end of a cattle guard crossing at the entrance to Rock House Ranch, located approximately 165 feet north of entrance to Foothills Trailer Park on a driveway parallel to and on the west side of Highway 93, Foothills Trailer Park entrance is west from the median crossing on Highway 93 0.4 mile north of mile post 114.
- RM3169 2102.4 Set aluminum cap on 1-inch rebar, marked FCDMC 413, 0.2 foot above ground, located on top of ridge bearing west approximately 300 feet south and 50 feet east of the northwest corner of section 18, T7N, R4W, N=1076073.11, E=456459.40.
- RM3195 2248.9 Set aluminum cap on 1-inch rebar, marked FCDMC 202, 0.2 foot above ground, located on the top of a hill, 1100 feet south, 2400 feet west of northeast corner of section 1, T7N, R5W, N=1085829.84, E=454108.68.
- RM3196 2060.90 Located 3 feet q southwest of southeast corner of guard at the intersection of Jack Burden Road and entrance Remuda Ranch. Stamped MCFCD, ERM01, ELEV. 2060.90, L5 2282, 1993 (Vertical Datum Only) (Wash N).
- RM3197 2081.4 Set aluminum cap on 1-inch rebar, marked FCDMC 406, 0.1 foot above ground, located 60 feet northwest of southeast corner of Constellation Road, 300 feet northeast of Recreo Road, located in the southeast quarter of section 1, T7N, R5W, N=1085378.31, E=455985.87.
- RM3198 2033.39 Brass cap stamped ADOT, ELEV. 2033.41, Sta. 1868+95.5. Top of culvert headwall east side of State Route 93, approximately 0.5 mile south of Wickenburg (Wash AF).
- RM3199 2032.92 U.S. Dept. of Agriculture brass cap set in concrete. No stamping. Located 60 feet q north along centerline of State Route 93 and 50 feet west of northwest corner of southeast corner of Calamity Wash bridge (Wash B).
- RM3200 2019.63 Brass cap stamped ADOT, elevation and station not legible, located top of north headwall on east side of State Route 93, approximately 0.6 mile north of mile post 114 (Wash O).
- RM3201 2199.35 Located 1.5 miles northeast along wash from the intersection of State Route 93 and wash, approximately 15 feet q above and south of flow line of wash on small ridge. Set 2-inch aluminum cap on 1-inch bar driven firmly into the ground with 0.5 foot above ground. Stamped MCFCD, ERM 205, ELEV. 2199.35, L5 2282, 1993 (Vertical Datum Only) (Wash O).
- RM3202 1994.80 Brass cap stamped ADOT with elevation and station not legible. Located on the east headwall of the State Route 93 culvert over Mockingbird Wash, approximately 2.5 miles south of Wickenburg (Wash E).
- RM3253 2064.4 Set PK nail near centerline of U.S. Highway 60, flush with pavement, located near the south line of section 1, T7N, R4W, N=1081387.82, E=456071.27.
- RM3254 2068.3 3-inch brass cap in concrete, flush with pavement, located at the centerline intersection of Mosquito and Center Streets, in the northeast quarter of section 12, T7N, R5W, N=1079849.53, E=452322.84.
- RM3264 2160.2 Chiseled + on top of east concrete curb of the south end of pavement of Kallis Road, also located in southeast quarter of section 12, T7N, R5W, N=1076431.65, E=451317.93.
- RM3265 2049.8 The corner of sections 12, 7, 13, and 18, T7N, R5W, monumented with a 3-inch-diameter GIO brass cap, 0.5 foot above ground, firmly set, and properly marked, N=1076410.90, E=456375.09.
- RM3277 2611.2 Set aluminum cap on 1-inch rebar, marked FCDMC 280, 0.7 foot above ground, located on the southerly side of the highest hill in the southeast quarter of section 14, T7N, R5W, N=1072622.04, E=450940.70.
- RM3279 2148.8 The corner of sections 13, 18, 24, and 19, T7N, R5W, monumented with a 3-inch-diameter BLM brass cap, 0.5 foot above ground, firmly set, and properly marked, N=107451.56, E=4456325.95.
- RM3280 2153.8 Set aluminum cap on 1-inch rebar, marked FCDMC 414, 0.3 foot above ground, located approximately 400 feet north and 400 feet west of RR bridge, in the southeast quarter of section 18, T7N, R4W, N=1071105.45, E=460372.53.
- RM3281 2028.0 Set aluminum cap on 1-inch rebar, marked FCDMC 407, 0.2 foot above ground, located approximately 400 feet north and 400 feet west of RR bridge, in the southeast quarter of section 18, T7N, R4W, N=1071105.45, E=460372.53.



LEGEND

To obtain more detailed information in areas where base flood elevations are shown, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within this Flood Insurance Study. Users should be aware that the information shown on this map is based on the most current information available and may not reflect the most current information available. Flood elevations shown on this map are based on the most current information available and may not reflect the most current information available. Flood elevations shown on this map are based on the most current information available and may not reflect the most current information available.

LEGEND

1. Areas of 500-year flood areas of 100-year flood with average depths of less than 1 foot, with damage areas less than 1 square mile, and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazard are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1981
Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Identified
Observed
Predicted None

Floodway Boundaries
Zone B Boundaries
Boundary Delineating Special Flood Hazard Zones and Boundary Delineating Areas of Different Flood Elevations Within Special Flood Hazard Zones
Base Flood Elevation Line
Elevation at 1-foot Sea-Mile Index for Evacuation Routes
Cross Section Line
Base Flood Elevation in Front of Structure Within Zone
See Map Index for Evacuation Datum, Elevation Reference Mark
River Mile
Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all potential features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BE's, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, AV, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 500 inch.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

This map incorporates approximate boundaries of Coastal Barrier Resource System Units and/or Observed Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-501).

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adding map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to repository listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
SEPTEMBER 23, 1989, SEPTEMBER 4, 1991

Map revised July 10, 2001 to update corporate limits, to change base flood elevations, to add base flood elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to update map format, to add road and rail names, and to incorporate previously issued Letters of Map Revision.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6623.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depth determined. For areas of alluvial fan flooding, vehicles also determined.

ZONE AV9 To be protected from 100-year flood by Federal Flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood areas of 100-year flood with average depths of less than 1 foot, with damage areas less than 1 square mile, and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazard are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1981
Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Identified
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Floodway Boundaries
Zone B Boundaries
Boundary Delineating Special Flood Hazard Zones and Boundary Delineating Areas of Different Flood Elevations Within Special Flood Hazard Zones
Base Flood Elevation Line
Elevation at 1-foot Sea-Mile Index for Evacuation Routes
Cross Section Line
Base Flood Elevation in Front of Structure Within Zone
See Map Index for Evacuation Datum, Elevation Reference Mark
River Mile
Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all potential features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BE's, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, AV, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 500 inch.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

This map incorporates approximate boundaries of Coastal Barrier Resource System Units and/or Observed Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-501).

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adding map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to repository listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
SEPTEMBER 23, 1989, SEPTEMBER 4, 1991

Map revised July 10, 2001 to update corporate limits, to change base flood elevations, to add base flood elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to update map format, to add road and rail names, and to incorporate previously issued Letters of Map Revision.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6623.

NATIONAL FLOOD INSURANCE PROGRAM

FIRM FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 255 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY NUMBER PANEL SUFFIX
MARICOPA COUNTY UNINCORPORATED AREAS 040056 0255 0
WICKENBURG TOWN OF STUDY 040056 0255 0

MAP NUMBER 0403C0255 G

MAP REVISED: JULY 10, 2001

Federal Emergency Management Agency



A.5 West Consultant's US-93 Bypass Drainage Report

**US-93 INTERIM WICKENBURG BYPASS
BRIDGE HYDRAULICS AND BANK PROTECTION REPORT**

Wickenburg, Arizona

DRAFT

Prepared for:

Arizona Department of Transportation

Phoenix, AZ

Prepared by:



WEST Consultants, Inc.

960 West Elliot Rd, Suite 201

Tempe, AZ 85284

March 28, 2005 (revised)

2. HYDROLOGY

2.1. *Flood Frequency Analysis*

Hassayampa River and Sols Wash flood discharges for different event frequencies were needed for the following purposes:

- To calculate the required levee height for the new US-93 road embankment (using 100-year flood elevation of the Hassayampa River plus 3 feet),
- To calculate the 50-year water surface elevation to meet the Arizona Department of Transportation freeboard requirement at bridges to exceed the 50-year water surface by at least 3 feet.
- For use in the sediment transport model, to simulate the effect of long-term changes in the river.

2.2. *Hassayampa River*

2.2.1. *Hassayampa River: Gage History*

The drainage area of the Hassayampa River at the US-60 bridge is 711 square miles (FEMA, 2001). The nearest upstream tributaries with basins of significant size are Sols Wash, located about 750 feet upstream of the US-60 crossing over the Hassayampa, and Martinez Wash, located about 2 ½ miles upstream of the US-60 crossing. Both of these washes are on the west side of the Hassayampa. Sols Wash at the confluence with the Hassayampa has a drainage area of 147.2 square miles (Maricopa County FIS), while Martinez Wash has a drainage area of 103 square miles (Yavapai County FIS, Table 7).

A USGS gaging station was previously present at Box Canyon (also known as Box Damsite) which is 8 miles upstream of the US-60 bridge near Wickenburg (09515500). The drainage area at this old Box Canyon gage is 417 square miles. In addition to the contributing area from Martinez Wash and Sols Wash, minor washes and local drainage contribute 44 square miles between the Box Canyon gage and the US-60. The peak flows at Box Canyon were recorded in 1925, 1927, 1937-38, and 1946-82. The flow of record for this gage is 58,000 cfs on 9/5/1970. The Morristown USGS gage (09516500) is about 8 miles downstream of the existing US-60 bridge. Peaks were recorded there from 1939-47, 1964-81, and 1983-2003. The peak of record for the Morristown gage is 47,500 cfs, on 9/5/1970.

In recent years, the Flood Control District of Maricopa County (FCDMC) has maintained pressure transducer gages on the Hassayampa River at Box Canyon, at the US-60, and near Morristown. These gages record stage levels every few minutes during flood events; these stages are converted to flows using a rating curve and are made available for download at the Flood Control District's website. The Box Canyon gage has been in place since October 1991. The flow of record for that gage is 15,451 cfs on 2/20/1993. The US-60 gage has been in place

since March 1994. The flow of record for that gage is 15,376 cfs on 9/26/1997. The Morristown gage has been in place since May 1996. The flow of record from the FCD for that gage is 9,095 cfs on 9/26/1997. A large difference in the peak flow for the 9/26/1997 event can be observed between the three gages: US-60 (15,376 cfs), Morristown gage (9,095 cfs), Box Canyon (3,549 cfs).

The largest flood for which a detailed hydrograph could be obtained (from Mr. Burt Duet, USGS Field Office, Tempe, Arizona, Ph: 480-736-1090) was the event of January 1993 at Morristown. This hydrograph was available in 15-minute increments, and this flood had a peak of 26,300 cfs.

2.2.2. Hassayampa River: Flood Frequencies

The current regulatory (FEMA) 100-year flood frequency for the Hassayampa River at Wickenburg is 71,000 cfs, with a drainage area of 711 square miles (FEMA, Maricopa County Flood Insurance Study, July 2001). The 10-year, 50-year, and 500-year floods are not published in the current flood insurance study (FIS). However, these floods appear in a previous FIS (FEMA Wickenburg FIS, 1977, revised 1983). The published values in that study are provided in Table 2-1.

Table 2-1. Hassayampa River Floods From July 1977 FEMA Wickenburg FIS (Revised 1983).

Location	Drainage Area (sq. miles)	10-year flood	50-year flood	100-year flood	500-year flood
0.32 miles (approximately) upstream from corporate limits	564	14,500	47,000	71,000	185,000
0.14 miles (approximately) downstream from corporate limits	671	14,000	46,000	70,000	184,000

There is a discrepancy in the drainage areas shown in the July 1977 FIS (revised 1983) study versus what is shown on the current FIS. The current FIS reports the drainage area of the Hassayampa at Wickenburg (downstream of Sols Wash) to be 711 square miles, which was verified to be approximately correct (within 1 square mile) by WEST based on a hydrologic unit code map and a stream network map. The 671 square miles shown in the 1977 FIS, and reproduced in Table 2-1 appears to be an error. Sols Wash is shown as having a drainage area of 145 square miles in the same study (it has 147 square miles according to the latest study).

Cella-Barr's 1988 analysis of the 100-year flood for the Hassayampa, which is largely based on flood frequency analysis, resulted in 100-year discharges somewhat lower than 71,000 cfs (Cella-Barr, 1988).

In the current flood insurance study, 71,000 cfs is used as the 100-year flood both upstream and downstream of Sols Wash. In the 1977 study (revised in 1983), 71,000 cfs is reduced to 70,000 cfs at some point downstream of Sols Wash. This flow reduction does not appear in the most recent (July 2001) FIS, and it was not adopted for this report. In the 1977 study, the 50-year flood in the reach upstream of Sols Wash is 47,000 cfs.

A flood frequency analysis was performed for the Morristown gage, located about 7 miles downstream of the US-60 bridge, and the Box Canyon gage upstream. The software program HEC-FFA was used (U.S. Army Corps of Engineers, 1992) and the results are summarized in Table 2-2.

Table 2-2. HEC-FFA Analysis

Gage	Number of events	Drainage Area, square miles	10-year flood, cfs	50-year flood, cfs	100-year flood, cfs	500-year flood, cfs	Comments
Hassayampa River at Morristown	47	796	19,400	46,200	60,800	141,000	Expected probability, Using regional skew of -0.1.
Hassayampa River at Box Canyon	38	417	10,000	47,100	67,200	100,000	Expected probability, Using regional skew of -0.1. Three events are historic (1925, 1927, 1937).

The flood frequency analysis for the bounding gages confirms that the 50-year flood of 47,000 cfs, from the 1977 FIS, is reasonable. The 47,000 cfs value was adopted for the 50-year flood, which established the freeboard requirement for the new US-60 bridge over the Hassayampa. The 100-year flood of 71,000 cfs from the FEMA study is slightly higher than our HEC-FFA analysis. Note that the 10-year flood from the 1977 FIS, at 14,500 cfs, is about halfway between the HEC-FFA values calculated for the 10-year flood at Morristown and at Box Canyon.

2.2.3. Hassayampa River: Superflood

For the superflood used by ADOT, the regulations specify that *“bridge foundations shall be checked to ensure that they will not fail due to scour resulting from the occurrence of flood in magnitude between the design event and a superflood on the order of a 500-year flood. A flood 1.7 times the magnitude of the 100-year flood may be used if the 500-year flood is not known.”* (ADOT Roadway Design Guidelines, p. 600-23, 1996). Although a 500-year flood is presented in the July 1977 FEMA Study (revised 1983), that flood event is not present in FEMA studies published more recently. Furthermore, the 185,000 cfs value is considerably greater than the 500-year floods from the flood frequency analysis for Box Canyon (100,000 cfs) and Morristown (141,000 cfs), as summarized in Table 2-2.

In light of the absence of the 500-year flood from recent FEMA studies, and the discrepancy between the gage analysis and the 185,000 cfs quoted in the 1977 FEMA study, the 500-year flood was taken as “not known.” Therefore, 1.7 times the magnitude of the 100-year flood was used for the superflood. This works out to $1.7 \times 71,000 \text{ cfs} = 120,700 \text{ cfs}$, which was adopted as the superflood.

2.2.4. Hassayampa River: Adopted Flood Discharges

The following table summarizes the adopted discharges, their origin, and the relevance of the flood to this project:

Table 2-3. Adopted Flood Discharges for Hassayampa River

	10-year	50-year	100-year	Superflood
Discharge, cfs	14,500	47,000	71,000	120,700
Source	1977 FIS	1977 FIS	2001 FEMA FIS, from Cella-Barr Study (Cella-Barr, 1988)	1.7 times 100-year; See section 2.2.3
Relevance	Establishing backwater conditions for Sols Wash	ADOT freeboard criterion and bridge scour analysis, backwater condition for Sols Wash	FEMA floodplain elevations, bank protection freeboard requirements, bank protection toe scour analysis, backwater condition for Sols Wash	Bridge scour analysis.

2.3. Sols Wash

2.3.1. Sols Wash: Gage History

The nearest gage on Sols Wash is at Sols Wash near Matthie, which has a drainage area of 121.4 square miles (compared to 147 square miles at the confluence with the Hassayampa). The Flood Control District of Maricopa County maintains that gage, which records flood events. The gage has been operating since August 4, 1995. The highest flow measured is 10,792 cfs which was recorded on 10/21/2001.

2.3.2. Sols Wash: Flood Frequencies

The FEMA published flood values for Sols Wash are: 10-year: 7,019 cfs, 50-year: 12,453 cfs, 100-year: 15,045 cfs, and 500-year: 20,836 cfs (FEMA, 2001). These values come from a TR-20 hydrologic model of the Sols Wash watershed by Cella-Barr Associates (Cella-Barr Associates, November 1985).

An internal memo obtained from the Corps of Engineers (Corps of Engineers, May 1992), gives discharges calculated by the Corps for the Flood Insurance Study of 1975 as 10-year: 4,000 cfs, 50-year: 16,500 cfs, 100-year: 24,000 cfs and 500-year: 59,000 cfs. These discharges are also referenced in a table in the Cella-Barr report (Cella-Barr Associates, November 1985).

The Cella-Barr report also refers to discharges from two other previous studies: a 1981 study by PRC Toups ("Hydrology Report, Sols Wash") and a 1974 study by the Soil Conservation Service ("Watershed Work Plan – Wickenburg Watershed, Maricopa and Yavapai Counties, Arizona"). The discharges from both of these studies are similar to those obtained by the 1985 Cella-Barr study.

For the purpose of this report, the current FEMA Flood Insurance Study Discharges (originally derived in the 1985 Cella-Barr study) were adopted.

2.3.3. Sols Wash: Summary of Adopted Discharges

The following table summarizes the adopted flood discharges, their origin, and their relevance for this project:

Table 2-4. Adopted Flood Discharges for Sols Wash

	10-year	50-year	100-year	500-year/ superflood
Discharge, cfs	7,019	12,453	15,045	20,836
Source	FEMA (2001), from Cella-Barr Study (Cella-Barr, 1985)	FEMA (2001), from Cella-Barr Study (Cella-Barr, 1985)	FEMA (2001), from Cella-Barr Study (Cella-Barr, 1985)	FEMA (2001), from Cella-Barr Study (Cella-Barr, 1985)
Relevance	ADOT freeboard requirements for Sols Wash bridge (with 50-year flood in Hassayampa as backwater)	ADOT freeboard requirement for bridge over Sols Wash (with 10-year flood in Hassayampa as backwater), scour analysis of Sols Wash bridge	FEMA floodplain elevations and delineation, scour hole analysis downstream of Sols Wash bridge	Scour analysis of Sols Wash bridge

3. QUALITATIVE GEOMORPHIC ANALYSIS OF PROJECT REACHES

Aerial photographs, topographic maps, and ADOT bridge inspection reports were used to analyze historical trends in the Hassayampa River and Sols Wash. The most useful of the historical data sources was a set of topographic workmaps based on 1971 topography (FCDMC, 1971).

3.1. Analysis of Topographic Maps and Elevation Data

The aerial topographic survey for this project was performed in 2003. The limits of the topography are from about 300 feet south of the existing US-60 bridges over the Hassayampa, extending north to almost 2 miles upstream of the US-60 bridges. The 2003 aerial topography also covers Sols Wash from the confluence with the Hassayampa until just upstream of the Tegner Street bridge. Additional topography for an area farther upstream on Sols Wash was obtained from JE Fuller; that topography was used for their Goldmine Village CLOMR (JE Fuller, 2002)

WEST Consultants obtained flood insurance study workmaps of the Hassayampa River from the early 1970's (based on aerial photography taken on 3/2/1971) from the warehoused archives of the FCDMC. This is the primary source of historical topography. These workmaps (hereafter referred to as the 1971 workmaps) have cross hairs showing grid coordinates, which made it

possible to geo-reference scans of these maps. The workmaps have a contour interval of four feet, and call out frequent spot elevations to the nearest 0.5 feet.

WEST also obtained workmaps from the Cella-Barr flood insurance studies (the effective flood insurance studies) for the Hassayampa River and Sols Wash. Cella-Barr's Hassayampa workmaps were based on aerial photography taken on March 8, 1988, and Cella-Barr's Sols Wash workmaps were based on aerial photography taken on March 13, 1986. The Cella-Barr drawings, however, are not a good source of topographic information because spot elevations are shown infrequently. Furthermore, the Cella-Barr Hassayampa workmaps have very low contrast, which makes the contours difficult to interpret. The vertical datum of all topographic maps, including the new mapping, is NGVD 1929.

In the part of the Hassayampa and Sols where the new topography is available, there does not appear to be a significant change in the bank lines since 1971. However, a comparison of 72 spot elevations from the 1971 workmap with the current topography shows that:

- The Hassayampa River has, on average, degraded slightly since 1971. The degradation is slightly more pronounced in the right overbank area of the channel (the area east and southeast of the racetrack). The degradation has been about 1 foot on average, with significant variations, for example the occasional disappearance or appearance of sandbars, and some shifts in the thalweg.
- There are six spot elevations on the 1971 workmap in Sols Wash downstream of Tegner Street. Five of the six points are higher in the recent topography, and one is lower, than shown on the 1971 map. The median elevation increase of these points is 1 foot, although one point is 2.5 feet higher. Therefore, Sols Wash appears to have aggraded slightly since 1971.
- A small region of the Hassayampa River, south of the Sols outlet into the Hassayampa, has aggraded since 1971. This is possibly due to sediment from Sols Wash settling out as the flow carrying it expands into the Hassayampa.

3.2. Cross Sections From ADOT Field Inspections

The Arizona Department of Transportation conducts periodic field inspections of its bridges. Part of the field inspection sometimes involves a series of measurements from the bridge low chord to the ground. WEST obtained the field inspection records for both the eastbound and westbound US-60 bridges over the Hassayampa. The eastbound bridge had a more complete set of measurements, extending back to 1968. The ADOT measured distances from the low chord were converted to elevations by using the surveyed 2004 elevations of the bridge low chord. The calculated elevations based on the ADOT surveys are shown in Figure 3.1. The long-term trend has been degradation, mostly on the east side of the channel which has degraded about 2 feet. The average degradation across the width of the channel at the bridge is about 1 foot from 1969 to 2001. The west side had continued to degrade until 1995, but between 1995 and 2001 aggraded back approximately to the 1968 level.

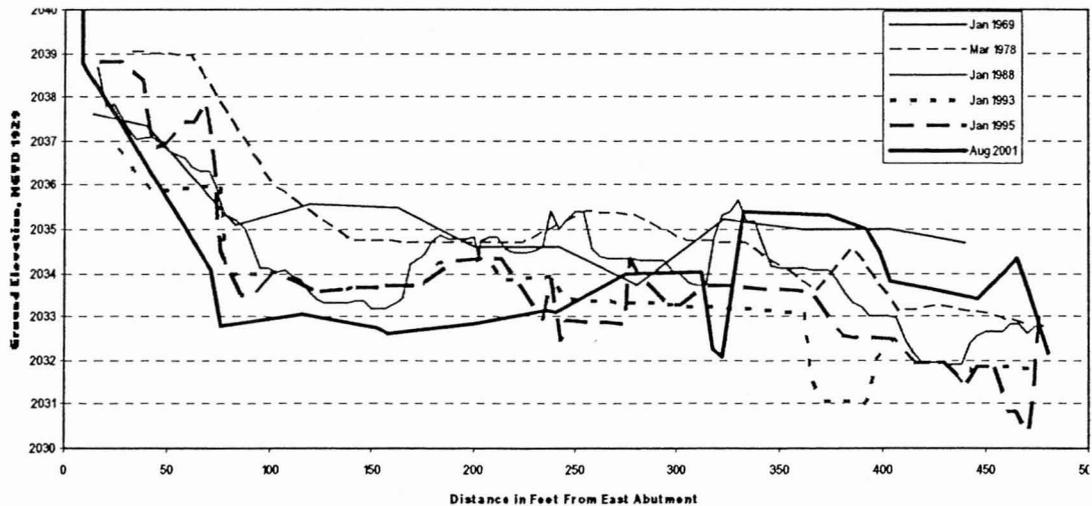


Figure 3.1. Historical Cross Sections based on ADOT measurements – Eastbound US-60 Bridge

3.3. Hassayampa Low Flow Channels based on 1971 and 2003 Topography

The thalweg for the Hassayampa River was delineated using the 1971 topography and the 2003 topography. The comparison region was limited by the 2003 topography, which extends about 6500 feet along the channel. In some places, the thalweg has shifted as much as 200 to 300 feet, but in other areas it is nearly unchanged. No trend could be discerned on the basis of the two topographic maps. Under the existing US-60 bridges, the thalweg has shifted to the east which is also confirmed by the ADOT bridge inspection reports.

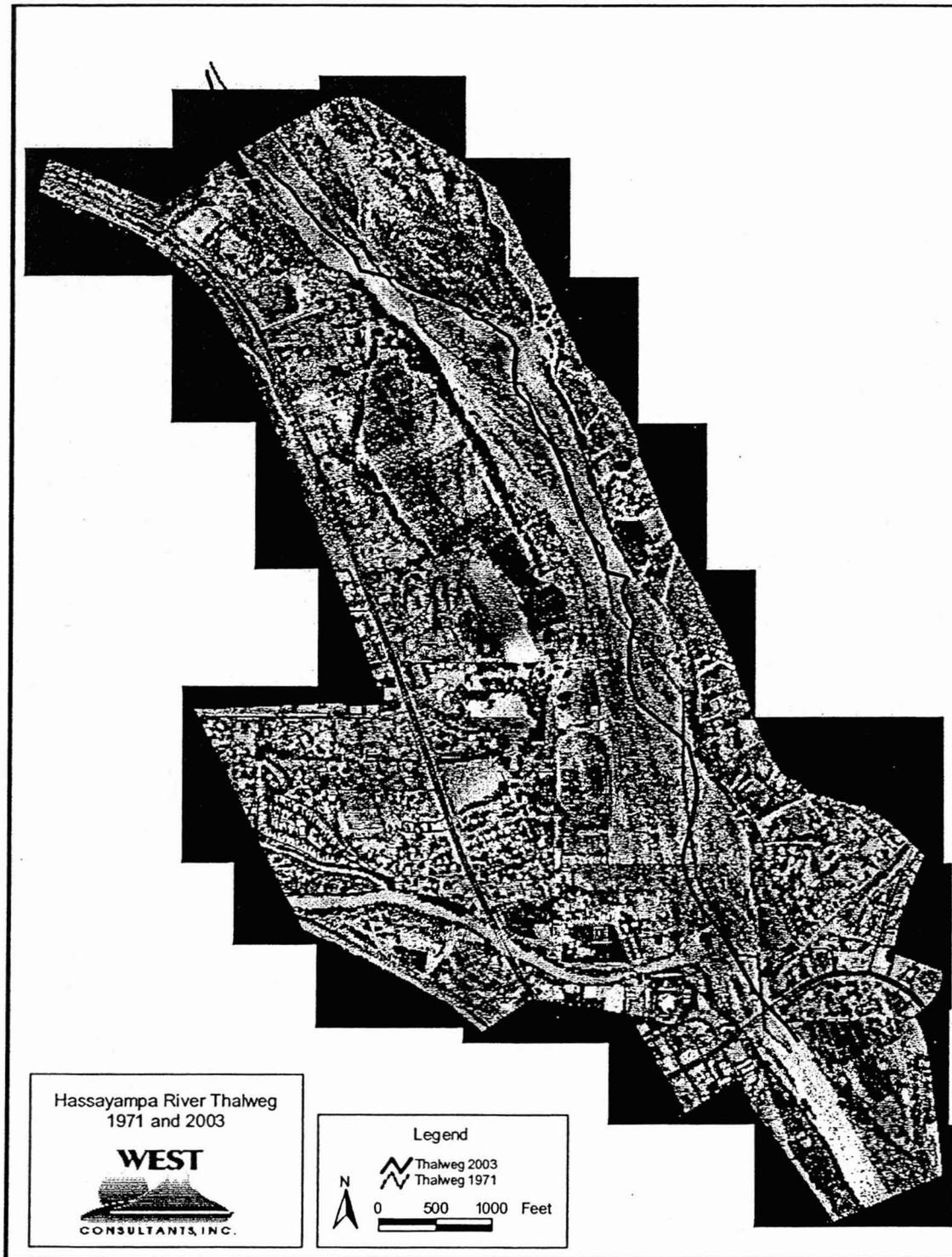


Figure 3.2. Hassayampa Thalweg Profiles 1971 versus 2003. Flow is north to south.

A plot of the thalweg profile by river station along the Hassayampa shows degradation at many river stations, little change at others, and slight aggradation in a few places. The thalweg profile

is shown in Figure 3.3. The irregularities in the 1971 thalweg profile may be due to inaccuracies from the 1971 topography, attributable to the large 4-foot contour interval. The one-foot contours from the 2003 topography yield a thalweg profile with a fairly uniform slope.

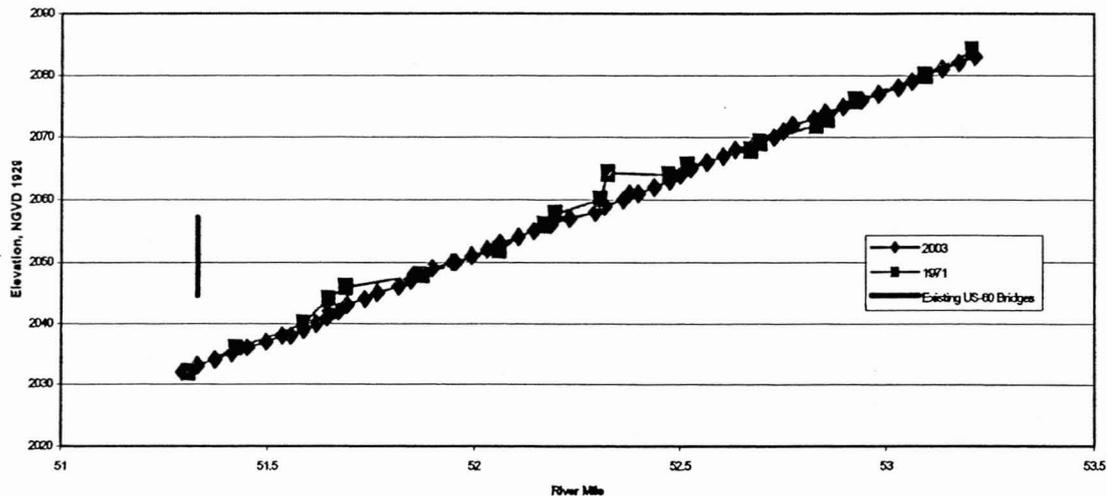


Figure 3.3 Historical Thalweg Profiles

3.4. Aerial Photography

Aerial photographs were used primarily to examine changes in vegetation. The photographs were also used to examine changes in the banklines in areas where the recent topography was not available.

WEST Consultants obtained historical aerial photographs of the project reach for the years 1953, 1984 and 1991. The photographs were used to delineate the horizontal bank locations in ArcView GIS and study lateral migration of the reach. These features in the older photographs were compared to the corresponding features in the recent aerial photography. A USGS digital orthographic quadrangle from 5/24/1997 was also available, which was used as the modern-day reference for regions beyond the limits of the 2003 aerial photography.

3.4.1. Changes since 1953

The 1953 aerial photograph was taken from a high altitude, and has fairly poor resolution. However, some major conclusions can be drawn. There are places where the vegetation line has moved. In an area near the upstream limit of the project, the channel appears to have straightened somewhat, however, most of the channel does not appear to have moved significantly. A region about 4,000 feet upstream of the US-60 bridges on the west bank, the vegetation line has moved about 100 feet, making the unvegetated channel wider now compared to that in 1953.

3.4.2. Changes since 1984 and 1991

The most recent aerial photographs indicate there is significantly less vegetation in the channel than in the 1991 and 1984 images. The 1953 image is not very sharp and is more difficult to interpret. However, the 1953 image shows vegetation in the channel, especially in the first 2500 feet downstream of the US-60 bridge.

The entire area appears to be less vegetated now than in the past. Even areas on the overbank, between the houses for example, show significantly less vegetation than in the 1991 photograph. The 1984 photograph appears to be slightly more vegetated than the 1991 photograph. The 1997 DOQQ shows more vegetation than the recent photograph, but less than in 1991. Thus, there seems to be a trend toward less vegetation from 1984 to 1991, and especially from 1993 to 2003.

Comparison of the banklines on the basis of vegetation was hampered by the reduction in vegetation over the years. Areas where it may appear that the bank has receded may in fact be due to the loss of vegetation which has occurred in the entire region.

In a 1000-foot reach downstream (south) of the racetrack (and upstream of the US-60 bridge), the vegetation line on the left (east) bank has moved since 1991 by about 40-80 feet farther east, moving it closer to Jack Burden Road. A small amount of shift in the same vegetation line appears to have occurred between 1984 and 1991 as well. Although the topographic information in this area from 1971 workmap is sparse, it appears that the channel has actually degraded in this area, and the main channel has worked its way east.

The biggest change between 1953 and 1984 was the appearance of the racetrack, and a patch of graded land next to it about 300 feet wide and 2000 feet long (the longer dimension parallel to the channel). By 1991, a road and what seems to be a number of corrals (or their remnants) appear on this patch of land. By 1997, and in the recent aeriels, evidence of the corrals is gone, apparently obliterated by sediment from the channel. The elevation of most of this area is within a couple of feet of the channel thalweg.

3.5. Conclusion: Qualitative Geomorphic Analysis

The floodplain and the channel appear to be reasonably stable laterally within the last 30-50 years or so. For example, the thalweg of the Hassayampa River in the project reach has scarcely moved in over 30 years. The region does appear to be less vegetated than in the past.

The river does meander somewhat, which creates the potential for bend scour. This is discussed in 7.3.2, where bend scour is calculated for a portion of the proposed embankment. Bend scour is also applied to the west abutment of the proposed Hassayampa bridge; this is discussed in 7.10.

Vertically, the Hassayampa River appears to have degraded slightly since 1971, while Sols Wash appears to have aggraded. The degradation in the Hassayampa means the long-term degradation will need to be considered for all the toe-down depths (bank protection and bridge scour).

4. HASSAYAMPA RIVER HYDRAULICS

There are two existing parallel bridges over the Hassayampa. The westbound (upstream) bridge was built in 1936. The eastbound (downstream) bridge was built in 1962.

For the Hassayampa River, there are five models mentioned in this report. The first model is the HEC-2 model from Cella-Barr, the remainder were developed by WEST using HEC-RAS version 3.1.2 (U.S. Army Corps of Engineers, 2002):

1. Effective Model. This the HEC-2 model from Cella-Barr upon which the existing flood insurance study is based.
2. Duplicate Effective Model. A version of the existing flood insurance study HEC-2 model, but in HEC-RAS. Modifications were made to the HEC-RAS to most faithfully duplicate the hydraulics and water surface elevations of the HEC-2 model. An encroached version of this model was also created.
3. Corrected Effective Model. The duplicate effective model with corrections made to some parameters and to the elevation of the bridges, when those parameters appeared to be incorrect in the effective model. An encroached version of this model was created.
4. Existing Conditions Model. A model of the hydraulics using the 2003 aerial topography.
5. Proposed Conditions Model. A model showing the hydraulics with the proposed embankment and bridge in place. This was constructed using the most recent topography, plus the plans of the new bridge and new road embankment.

The first three models were created to comply with FEMA requirements for a future Conditional Letter of Map Revision. The fourth, existing conditions, model was used to establish the current hydraulics. The final model, the proposed conditions model, establishes the future hydraulics. The most relevant comparisons are between the proposed conditions and the existing conditions models, since the differences show the impacts of the project.

4.1. *Vertical and Horizontal Datum*

The vertical datum of the FIS (Cella Barr) models is NGVD 1929 according to the published flood insurance profiles for the Hassayampa and Sols Wash (FEMA, 2002). The new topography and all other elevations were also in the same vertical datum.

The horizontal datum of the mapping was performed using a "ground" coordinate system established for this project. Ground coordinates can be obtained by converting from the Arizona State Plane Central NAD83 grid, International Feet. State plane coordinates, international feet, multiplied by a grid-to-ground scale factor of 1.00013938 yields the ground coordinates for this project (memo from Chuck Gardner of Project Engineering Consultants, Ltd. to Dan Stough of

Jacobs Engineering, January 30, 2004, and personal communication with Chuck Gardner on November 12, 2004).

4.2. Hassayampa River Duplicate Effective Model

The effective flood insurance model of Hassayampa River in Maricopa County is based on nine HEC-2 models, each consisting of one reach of the river. The region with the US-60 bridge is in the ninth, and most upstream, reach of the model. The original HEC-2 files have the names HASS.R9 (unencroached profile) and HASS.F9 (encroached profile). Since the Hassayampa River also extends upstream into Yavapai County, separate models which were used to delineate the floodplain in Yavapai County are available. However, those reaches were not needed for this study.

A duplicate effective model was created for this reach first importing the HEC-2 model's geometry into HEC-RAS. The import process copied the cross-section geometries, bridge geometries, n-values, and bank stations. In addition to the imported geometry, the following steps were taken so that the HEC-RAS model would match the HEC-2 model:

- The downstream boundary condition at cross-section 49.04, the downstream limit of reach 9, was transferred from HEC-2 to the HEC-RAS model. For the unencroached profile, the water surface elevation was 1982.65 feet, while for the encroached profile it was 1983.05 feet.
- The discharges were set per the HEC-2 model: 71,000 cfs at cross sections 50.46 and upstream, and 67,635 cfs at cross-section 50.4 and downstream. The 67,635 cfs in the downstream reach is not mentioned in the published Flood Insurance Study, even though it appears in the model (the 67,635 cfs discharge begins almost a mile downstream of the existing conditions or proposed conditions models and is not used in either of them).
- The encroachment stations were copied from the HEC-2 model to the HEC-RAS model.
- The conveyance calculation option was changed to the HEC-2 method, where conveyance is calculated separately between each cross-section point on the overbanks.
- The internal bridge cross-sections for the US-60 bridge between cross-sections 51.33 and 51.34 (HEC-RAS assigned the bridge to section 51.335 on importation from HEC-2) were modified. HEC-RAS uses the bounding cross-sections to establish the geometry under the bridge. In the HEC-2 model, the bridge was coded as a special bridge (SB), and the area under the bridge appears in Field 7 of the SB card. It was coded as 4650 square feet. Because the bounding cross-sections for the bridge resulted in an area lower than this, the internal bridge cross-sections in the duplicate effective model needed to be modified. The internal cross-sections were modified to be rectangular sections such that the area under the bridge low chord, excluding piers, was 4650 square feet.

- The contraction and expansion coefficients at cross-sections 50.4, 50.46, 50.56, and 50.65 were set a 0.2 and 0.4, respectively. These were the coefficients used in the HEC-2 model for these sections. At all other cross sections the contraction and expansion coefficients were set at 0.1 and 0.3 as in the HEC-2 model.

With these modifications, the water surface profile for the HEC-RAS unencroached Duplicate Effective model's elevations are within 0.01 feet of the HEC-2 model's elevations at every cross-section.

For the encroached HEC-RAS effective model, the water surface profile is within 0.01 feet at most cross-sections. However, for the cross-sections upstream of the existing bridges, and the next few cross-sections, the duplicate effective model has more than 1.0 feet of surcharge. The reason is that the encroached HEC-2 model neglects to consider the encroachment at the bridge section, and as a result, erroneously allows for conveyance in the right overbank at the bridge section of the encroached model. In HEC-RAS, the encroachment stations at the upstream and downstream section automatically cause the bridge to be encroached as well.

4.3. *Hassayampa River Corrected Effective Model*

The following modifications were made to the duplicate effective model to create the corrected effective model:

- The bridge low chord elevations were modified. In the effective model, the bridge is shown as having a uniform low chord of 2043.3 feet. A field survey was conducted to check the low chord elevations, they are summarized in Table 4-1. For the corrected effective model, the elevations from the 1936 bridge, which is the lower of the two bridges, were used.

Table 4-1. Existing Hassayampa bridges low chord elevations as surveyed in March 2004

	At East Abutment	Center	At West Abutment
1936 bridge (westbound)	2044.62	2045.47	2044.62
1962 bridge (eastbound)	2046.79	2047.42	2046.75

- The bridge was changed from having a single 40-foot wide pier (as it is represented in the HEC-2 model) to having 5 piers, each 4 feet wide at the top, widening at a ratio of 1:24 on each side. This is the pier configuration of the 1936 bridge, which has wider piers than the 1963 bridge, and provides the larger obstruction to flow.
- An ineffective flow area was added at cross-section 51.4. This cross section is 300 feet upstream of the face of the bridge. A large portion of this cross-section is in the "hydraulic shadow" of a plateau on the left side of the channel. This portion of the cross-section would be ineffective for flow.
- An ineffective flow area was added at cross-section 51.29, which is downstream of the bridge. The leftmost 580 feet of the cross-section inside the floodway is in the hydraulic "shadow" of the bridge and should not be considered effective flow.

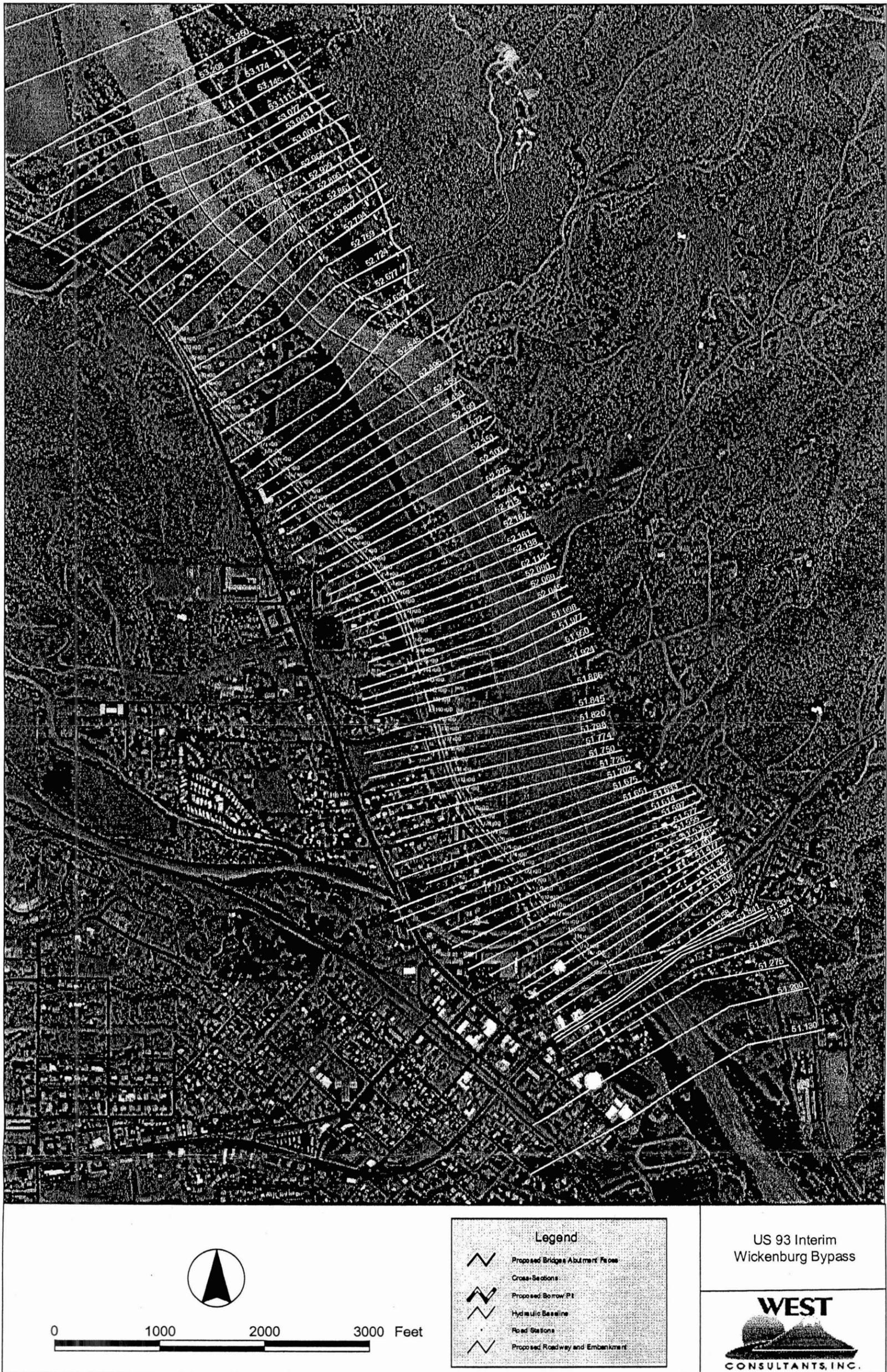


Figure 4.1. Study Area with Hassayampa River Cross Sections. Hassayampa River flows north to south.

The cross-sections for the proposed conditions model incorporate the proposed embankment and bridge. All the cross-sections cutlines from the existing conditions model are in the proposed conditions model. There is one additional cross-section in the proposed conditions model, section 51.334. Section 51.334 is just upstream of the 1962 (eastbound) bridge. In the existing conditions model, the cross section is not present because the eastbound and westbound bridges are taken together as one equivalent bridge, and the bounding cross-section (51.341) for that equivalent bridge is farther upstream.

The hydraulic ineffective flow areas caused by the new abutments were considered, with a 1:1 contraction rate upstream of the proposed bridge, and a 2:1 expansion rate downstream of the 1962 bridge. These ineffective flow limits on the downstream side are unchanged from the existing conditions model since the existing embankments will remain in place.

The existing bridge has railbank protection on the left abutment which obstructs some of the flow. This was modeled in HEC-RAS by placing a blocked obstruction which was offset by 15 feet from the left abutment.

The proposed Hassayampa bridge abutments are skewed 17 degrees to the portion of the bridge that is straight. The alignment of the abutments was set to be parallel to the estimated flow direction from a 100-year flood in the Hassayampa River.

Table 4-3 shows the 100-year water surface elevations between the FIS model, the Corrected Effective Model, the Existing Conditions Model, and the Proposed Conditions Model. It also shows, in the last column, the difference between the proposed encroached condition and the existing condition. Encroachments are discussed further in section 0. Figure 4.3 shows the profiles graphically. Cross-Sections from the FIS model are only included in the table when they are coincident or very close to the cross sections of HEC-RAS model.

Table 4-3. Hassayampa River 100-year Water Surface Profiles, NGVD 1929 Feet

Cross Section	Equivalent FIS Section	Effective	Corrected Effective	Existing Conditions	Proposed Conditions	Increase, Feet
53.25	53.25	2091.05	2091.05	2090.91	2090.91	0.00
53.208				2090.12	2090.12	0.00
53.174				2088.93	2088.93	0.00
53.145	53.16	2088.39	2088.4	2088.44	2088.44	0.00
53.111				2087.56	2087.56	0.00
53.077				2086.75	2086.75	0.00
53.043	53.06	2085.3	2085.3	2085.87	2085.87	0.00
53.006				2084.90	2084.9	0.00
52.966				2084.15	2084.15	0.00
52.929				2083.58	2083.58	0.00
52.896				2083.17	2083.17	0.00
52.861	52.87	2081.92	2081.93	2082.73	2082.73	0.00
52.827				2081.61	2081.61	0.00
52.794				2080.22	2080.22	0.00
52.759				2079.17	2079.17	0.00
52.724				2077.90	2077.9	0.00
52.677				2076.34	2076.35	0.01
52.632				2074.32	2074.3	-0.02
52.587				2072.74	2072.82	0.08
52.545				2071.66	2071.95	0.29

Cross Section	Equivalent FIS Section	Effective	Corrected Effective	Existing Conditions	Proposed Conditions	Increase, Feet
52.496				2070.52	2071.14	0.62
52.456				2069.67	2070.28	0.61
52.43				2069.12	2069.82	0.70
52.399	52.4	2069.87	2069.87	2068.66	2069.36	0.70
52.372				2068.23	2068.88	0.65
52.351				2067.58	2068.21	0.63
52.306	52.3	2068.09	2068.09	2066.93	2067.61	0.68
52.275				2066.40	2066.85	0.45
52.241				2065.84	2066.12	0.28
52.215	52.21	2065.22	2065.22	2064.87	2065.47	0.60
52.187				2064.23	2064.81	0.58
52.161				2063.26	2063.72	0.46
52.138				2062.67	2063.17	0.50
52.112				2061.67	2061.98	0.31
52.09				2060.85	2061.15	0.30
52.069				2060.09	2060.52	0.43
52.045				2059.76	2059.97	0.21
52.021				2059.04	2059.15	0.11
51.998				2058.69	2058.78	0.09
51.977				2058.13	2058.21	0.08
51.95				2057.72	2057.77	0.05
51.924				2057.28	2057.34	0.06
51.886				2056.37	2056.51	0.14
51.845	51.83	2056.04	2056.01	2055.72	2055.52	-0.20
51.82				2055.40	2055.02	-0.38
51.798				2055.17	2054.39	-0.78
51.774				2054.99	2053.98	-1.01
51.75	51.74	2052.45	2052.51	2054.76	2053.58	-1.18
51.726				2054.71	2053.39	-1.32
51.702				2054.66	2053.16	-1.50
51.675				2054.61	2053.02	-1.59
51.651	51.64	2051.68	2051.8	2054.58	2052.95	-1.63
51.633				2054.54	2052.89	-1.65
51.614				2054.52	2052.84	-1.68
51.597				2054.42	2052.65	-1.77
51.577				2054.37	2052.51	-1.86
51.555	51.55	2051.06	2051.2	2054.30	2052.4	-1.90
51.534				2054.26	2052.3	-1.96
51.515				2054.27	2052.21	-2.06
51.497				2054.19	2051.99	-2.20
51.477				2054.12	2051.93	-2.19
51.452	51.45	2050.73	2050.89	2053.89	2051.47	-2.42
51.435				2053.80	2051.16	-2.64
51.417				2053.78	2051.06	-2.72
51.396	51.4	2050.41	2050.37	2053.63	2050.3	-3.33
51.378				2053.44	2048.79	-4.65
51.358				2053.40	2046.98	-6.42
51.341	51.34	2049.01	2048.85	2052.78	2046.69	-6.09
51.334					2046.55	
51.327	51.33	2044.95	2045.75	2045.46	2044.11	-1.35
51.302				2042.85	2042.99	0.14
51.275				2041.36	2041.47	0.11
51.2	51.2	2039.38	2039.4	2039.47	2039.47	0.00
51.13	51.13	2037.45	2037.47	2037.45	2037.45	0.00

Table 4-4. Summary of Floodway (encroached) water surface profiles

Cross Section	Existing Conditions Water Surface Elevation	Proposed Conditions Water Surface Elevation	Effective (FIS) Encroached Water Surface Elevation	Encroached Existing Conditions (with existing floodway)	Encroached Existing Conditions (with proposed floodway)	Encroached Proposed Conditions (with proposed floodway)	Encroached Proposed Minus Existing Conditions
53.25	2090.91	2090.91	2091.49	2091.08	2091.08	2091.08	0.17
53.208	2090.12	2090.12		2090.48	2090.48	2090.48	0.36
53.174	2088.93	2088.93		2089.74	2089.74	2089.74	0.81
53.145	2088.44	2088.44	2089.13	2089.22	2089.22	2089.22	0.78
53.111	2087.56	2087.56		2088.41	2088.41	2088.41	0.85
53.077	2086.75	2086.75		2087.6	2087.6	2087.6	0.85
53.043	2085.87	2085.87	2086.18	2086.71	2086.71	2086.71	0.84
53.006	2084.9	2084.9		2085.49	2085.49	2085.49	0.59
52.966	2084.15	2084.15		2084.57	2084.57	2084.57	0.42
52.929	2083.58	2083.58		2083.84	2083.84	2083.84	0.26
52.896	2083.17	2083.17		2083.18	2083.18	2083.18	0.01
52.861	2082.73	2082.73	2081.95	2082.68	2082.68	2082.68	-0.05
52.827	2081.61	2081.61		2081.58	2081.58	2081.58	-0.03
52.794	2080.22	2080.22		2080.28	2080.28	2080.28	0.06
52.759	2079.17	2079.17		2079.22	2079.22	2079.21	0.04
52.724	2077.9	2077.9		2078.07	2078.08	2078.08	0.18
52.677	2076.34	2076.35		2076.27	2076.27	2076.27	-0.07
52.632	2074.32	2074.3		2074.29	2074.3	2074.29	-0.03
52.587	2072.74	2072.82		2073.01	2072.88	2072.9	0.16
52.545	2071.66	2071.95		2072.32	2072.05	2072.09	0.43
52.496	2070.52	2071.14		2071.55	2071.1	2071.21	0.69
52.456	2069.67	2070.28		2070.83	2070.36	2070.49	0.82
52.43	2069.12	2069.82		2070.34	2069.9	2070.01	0.89
52.399	2068.66	2069.36	2070.75	2069.86	2069.44	2069.54	0.88
52.372	2068.23	2068.88		2069.26	2068.89	2068.96	0.73
52.351	2067.58	2068.21		2068.61	2068.27	2068.34	0.76
52.306	2066.93	2067.61	2068.78	2068.06	2067.73	2067.8	0.87
52.275	2066.4	2066.85		2067.2	2066.91	2066.95	0.55
52.241	2065.84	2066.12		2066.55	2066.3	2066.29	0.45
52.215	2064.87	2065.47	2065.78	2065.81	2065.74	2065.65	0.78
52.187	2064.23	2064.81		2065.06	2065.1	2065.1	0.87
52.161	2063.26	2063.72		2063.88	2063.96	2063.96	0.7
52.138	2062.67	2063.17		2063.37	2063.39	2063.39	0.72
52.112	2061.67	2061.98		2062.23	2062.25	2062.25	0.58
52.09	2060.85	2061.15		2061.5	2061.5	2061.51	0.66
52.069	2060.09	2060.52		2060.98	2060.98	2060.98	0.89
52.045	2059.76	2059.97		2060.49	2060.48	2060.48	0.72
52.021	2059.04	2059.15		2059.79	2059.79	2059.79	0.75
51.998	2058.69	2058.78		2059.3	2059.3	2059.3	0.61
51.977	2058.13	2058.21		2058.51	2058.49	2058.49	0.36
51.95	2057.72	2057.77		2058.02	2058	2058	0.28
51.924	2057.28	2057.34		2057.56	2057.53	2057.53	0.25
51.886	2056.37	2056.51		2056.6	2056.51	2056.51	0.14
51.845	2055.72	2055.52	2056.05	2055.75	2055.48	2055.48	-0.24
51.82	2055.4	2055.02		2055.36	2055	2055	-0.4
51.798	2055.17	2054.39		2054.96	2054.4	2054.4	-0.77
51.774	2054.99	2053.98		2054.75	2054.08	2054.05	-0.94
51.75	2054.76	2053.58	2052.77	2054.58	2053.73	2053.66	-1.1
51.726	2054.71	2053.39		2054.52	2053.55	2053.46	-1.25
51.702	2054.66	2053.16		2054.46	2053.36	2053.26	-1.4
51.675	2054.61	2053.02		2054.4	2053.22	2053.11	-1.5

Cross Section	Existing Conditions Water Surface Elevation	Proposed Conditions Water Surface Elevation	Effective (FIS) Encroached Water Surface Elevation	Encroached Existing Conditions (with existing floodway)	Encroached Existing Conditions (with proposed floodway)	Encroached Proposed Conditions (with proposed floodway)	Encroached Proposed Minus Existing Conditions
51.651	2054.58	2052.95	2052.2	2054.36	2053.13	2053.01	-1.57
51.633	2054.54	2052.89		2054.31	2053.05	2052.93	-1.61
51.614	2054.52	2052.84		2054.27	2052.98	2052.85	-1.67
51.597	2054.42	2052.65		2054.18	2052.82	2052.67	-1.75
51.577	2054.37	2052.51		2054.12	2052.67	2052.51	-1.86
51.555	2054.3	2052.4	2051.64	2054.01	2052.53	2052.36	-1.94
51.534	2054.26	2052.3		2053.96	2052.41	2052.24	-2.02
51.515	2054.27	2052.21		2053.94	2052.32	2052.14	-2.13
51.497	2054.19	2051.99		2053.9	2052.07	2051.9	-2.29
51.477	2054.12	2051.93		2053.83	2052.02	2051.85	-2.27
51.452	2053.89	2051.47	2051.23	2053.4	2051.61	2051.38	-2.51
51.435	2053.8	2051.16		2053.34	2051.52	2051.16	-2.64
51.417	2053.78	2051.06		2053.22	2051.38	2051.06	-2.72
51.396	2053.63	2050.3	2050.82	2052.84	2050.44	2050.3	-3.33
51.378	2053.44	2048.79		2052.46	2049.01	2048.79	-4.65
51.358	2053.4	2046.98		2052.14	2048.96	2046.98	-6.42
51.341	2052.78	2046.69	2049.75	2052.01	2048.68	2046.69	-6.09
51.334		2046.55				2046.55	
51.327	2045.46	2044.11	2045.72	2046.98	2044.41	2044.13	-1.33
51.302	2042.85	2042.99		2043.41	2042.94	2042.95	0.1
51.275	2041.36	2041.47		2041.89	2042.09	2042.09	0.73
51.2	2039.47	2039.47	2040.17	2040.27	2040.27	2040.27	0.8
51.13	2037.45	2037.45	2037.62	2037.62	2037.62	2037.62	0.17

Table 5-1. Freeboard at Proposed Sols Wash Bridge

Flood	Configuration	Discharge, Sols Wash	Hassayampa model discharge downstream of Sols Wash (to obtain backwater condition at Sols Wash)	Upstream water surface at proposed sols wash bridge	Freeboard, in feet, with bridge low chord at 2053.23
50-year floods	Sols 10-Year with Hassayampa 50-year backwater	7019 (Sols 10-year)	54,019 = 7,019 (Sols 10-year) + 47,000 (Hassayampa 50-year)	2049.80	3.43 (controls)
	Sols 50-Year with Hassayampa 10-year backwater	12,453 (Sols 50-year)	26,953 = 12,453 (Sols 50-year) + 14,500 (Hassayampa 10-year)	2048.38	4.85
100-year floods	Sols 100-Year w/Hassayampa 10-year backwater	15,045 (Sols 100-year)	29,545 = 15,045 (Sols 100-year) + 14,500 (Hassayampa 10-year)	2049.27	3.96
	Sols 10-year w/Hassayampa 100-year backwater	7019 (Sols 10-year)	71,000 (Hassayampa 100-year flood)	2052.24 (controls)	0.99 (controls)

Note that to obtain the backwater condition from the Hassayampa, the discharge used in the Hassayampa model was the sum of the discharges of the Hassayampa flood and the Sols Wash flood, with one exception. The exception was that the for 10-year Sols Wash event combined with 100-year Hassayampa event, the 100-year Hassayampa flood was used to establish the backwater condition in the Hassayampa River model. It was judged that adding the 10-year Sols Wash flood to this 100-year Hassayampa flood was excessively conservative, since it would have led to taking a backwater condition from a flood that had greater than a 100-year recurrence interval.

6. SEDIMENT TRANSPORT ANALYSIS

For the Hassayampa River sediment model, the main function is to predict long term changes in the profile of bed. Factors considered include the borrow pit, the presence of the new embankment, and the construction of the new abutments for the proposed bridge.

6.1. Determination of Runoff Hydrographs for Sediment Models

6.1.1. Hassayampa River

To run the sediment transport model (HEC-6T) simulations, a series of hydrographs needed to be developed. Simulated future hydrographs are required to determine whether the project is likely to have a significant impact on the deposition or degradation in the reach. The objective is to correctly simulate both the peak and general hydrograph shape which would correspond to actual hydrographs that the reach might experience.

The historical record was used to generate the simulated future hydrographs. Ideally, the actual hydrographs of historical events should be used for the sediment model. Although there are years of data of hydrograph peaks, data on the shape and duration is difficult to obtain. There is no known hydrologic model for this basin. Detailed hydrographs are available only since the 1990's, when numerous gages were installed by both the USGS and FCD.

FCD pressure transducer gages have been in operation since March 1994 at the US-60, and since May 1996 at Morristown. Another FCD gage at Box Canyon has been in operation since 1991.

There are significant differences in the recorded hydrographs for a particular event between gages. The January 1993 event exemplifies this: in January 1993 the Box Canyon gage (USGS) registered almost no flow, while the Morristown gage recorded a peak of 26,300 cfs. For the September 1997 event, the Box Canyon gage peak was 3,421 cfs, the US-60 peak was 15,367 cfs, and the Morristown peak was 9,095 cfs.

The flow volumes calculated from the hydrographs are also significantly different, even from the US-60 gage to the Morristown gage downstream. For the September 1997 event, integrating the hydrograph shows that about 185 million cubic feet passed the US-60 gage. For the Morristown gage downstream, for the same event, only 51 million cubic feet passed the gage. Either there was some error in one of the two rating curves, or measurement error, or most of the discharge infiltrated between the two locations.

The largest event for which a hydrograph is available is the January 1993 event at the Morristown gage. This event had a peak flow of 26,300 cfs. Based on the USGS hydrograph, the total volume of flow for this event is in just over 1 billion cubic feet. This volume is considerably larger than that for the September 1997 event (185 million cubic feet). The ratio of volumes between the two events is about 5:1 while the ratio of peaks is about 3:1. This is because the January 1993 flood had a longer duration—so the hydrograph is not only taller (peak discharge), but is wider (longer duration).

The following data were used to develop the hydrographs for the Hassayampa HEC-6T sediment transport model:

- 48 annual peak flow records for the USGS Morristown gage near the Hassayampa. These peak flow records are from 1939 to 1947 and from 1964 through 2003 (with 1 year missing). This gage is about 8 miles downstream of the US-60.

- Detailed hydrographs for all flood events, from the Flood Control District, for all dates since 3/14/1994 at the US-60 gage.
- A 15-minute interval hydrograph obtained from the USGS, at the Morristown gage, for the event of 1/6-10/1993. This event had a peak of 26,300 cfs, the third largest peak on record for this gage.
- The flow-frequency curve based on the FEMA floods (both from the current and 1977 study).

For dates after 3/14/1994, the FCD detailed real-time gage record was used to model the historical record. For 1993 and prior, when a peak flow was available from the Morristown gage, a simulated hydrograph was created using the following procedure:

- Using the flow-frequency relationship from the FFA analysis of Morristown, the exceedance interval of each flood was established. For example, the October 1984 flood of 26,700 cfs at Morristown is equivalent to the 5.3% (or 18.8 year) exceedance event.
- That exceedance interval was used to “look up” the corresponding flood peak at the US-60, using the flow-frequency curve from the FIS-specified floods. For example, the 18.8 year event at the US-60 is 24,070 cfs.
- The detailed hydrograph with the closest peak was identified (either one of the FCD hydrograph since 1994 or the 1993 Morristown hydrograph). For example, for a peak of 24,070 cfs, the detailed hydrograph with the nearest peak is the January 1993 hydrograph from Morristown.
- The detailed hydrograph ordinates (flows) were all scaled up or down to make the peak of the hydrograph match the peak estimated from (b). For example to obtain a peak flood of 24,070 cfs, the discharges on the 1993 Morristown hydrograph were all multiplied by $24,070 / 26,300 = 0.915$, resulting in the simulated 1984 hydrograph at the US-60.
- The end result for each year’s peak flow was a simulated hydrograph with the same peak flow.
- Combining these simulated hydrographs with the 1994 and more recent gage records from the FCD gage led to a series of hydrographs that simulates about 48 years of gage record. It should be noted that the highest simulated peak flow from this combined series of events is 54,984 cfs, which comes from the simulated hydrograph of 9/5/1970 for Morristown. The Morristown peak on this date was 47,500 cfs, which interpolates as the 64.6-year flood at Morristown. Looking up the 64.6 year flood on the Hassayampa Flood Frequency curve yields a peak of 54,984 cfs.
- In addition to a 48-year simulation, another hydrograph using the 100-year peak flow of 71,000 cfs was added to the end of the simulated flow record. This series of

hydrographs was labeled as the "long-term" flow simulation that was run through HEC-6T.

6.2. Sediment Model Parameters

6.2.1. Boundary Condition

Using normal flow considerations, an elevation-discharge Rating Curve based on the HEC-2 models were developed to establish the downstream boundary conditions.

6.2.2. Manning's Roughness

To arrive at conservative estimate for the sediment transport analysis the Manning's n values were lowered to a value of 0.025 in the channel and 0.035 for the overbanks. The lowered Manning's n values will result in increased erosion resulting in lower values of average bed and thalweg elevations. This, in turn, will provide a higher value for the scour depth building in conservatism in the estimates.

6.3. Sediment Data

The decisive factor in selecting the proper sediment transport function was based on available bed gradation and maximum grain size. Bed material in the project location is comprised of sand and gravel, making it necessary to use an appropriate transport function. The transport function used in the study is based on Yang Stream Power (Thomas, W.A., 2002). This function accounts for sand and gravel, giving a higher, realistic measure of total sediment concentration (and thus total sediment load).

6.3.1. Bed Sediment Characteristics

The sediment gradation curves for various samples are presented in Figure 6.1.

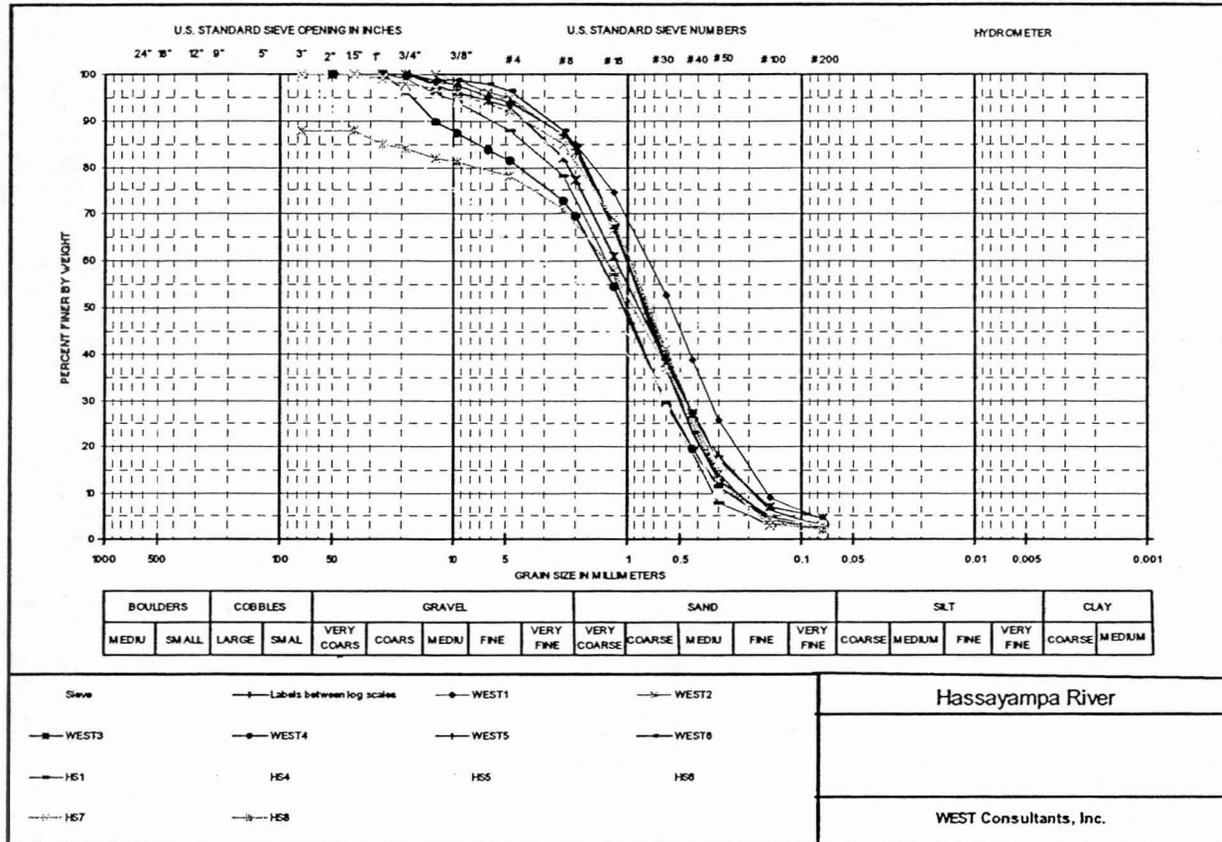


Figure 6.1. Sediment Gradations At Various Locations Along Hassayampa

Different gradations were used in the sediment model, assigned by their location to the appropriate cross sections in the sediment model. As can be seen in Figure 6.1, the D_{50} ranges from just over 0.5 mm to just over 1 mm. The median D_{50} of the different samples is about 0.8 mm.

6.3.2. Inflowing Sediment Load

The sediment transport model cannot be directly calibrated to historical conditions because detailed historical bed elevation data are not readily available. The HEC-6T model requires input of the bed material load at the upstream limit of the project reach for the entire range of discharges. For this purpose, the HEC6-T model developed was run with the recirculation option (\$RE, See Thomas, W.A. 2002). This model considers the reach in the upstream part of the study reach where the recirculation of sediment load is performed until steady sediment inflow is obtained. The values obtained in this manner are input into the present HEC-6T model at the upstream most cross section located at 53.72.

6.3.3. Movable Bed and Erosion Limits

In general, sediment dynamics tend to be more significant within the active channel, where the bed can either degrade or aggrade in response to erosion or deposition. The overbank areas tend to be more stable and normally are free of erosion, but can experience deposition. HD records

were used to specify a bed sediment depth of 25 feet for all cross sections. Movable bed limits were identified at the boundary of the main channel in HD records. The movable bed limits extend beyond the defined bank stations. During high flows, significant deposition and scour was expected to occur within the movable bed limits but not expected to extend to the overbank areas.

Average bed elevations were generated using movable bed limit bank limits. This allowed wetting of the movable bed cross sections and provide an average elevation across the cross section.

6.4. Sediment Transport Results

The HEC-6T model simulations were performed to predict the long-term degradation. Simulations were performed for the following scenarios: a) Existing geometry b) Proposed geometry without borrow pit and c) Proposed geometry with borrow pit. The purpose of modeling the borrow pit was to determine the possible tailcut in the downstream direction, which could impact the scour conditions for the soil cement protection of the road embankment, and to estimate the depth and extent of the headcut in the upstream direction.

The proposed conditions HEC6-T model was developed using the existing conditions model as the base and by incorporating the new bank alignment as encroachments. The rest of the model is identical to the existing conditions model. The proposed-with-pit conditions model was also based on the corresponding HEC-RAS model with the flow being diverted into the pit in the upstream end of the model.

The results are presented in Figure 6.2 and Figure 6.3 which shows the changes in the average bed elevations and the thalweg respectively. From the results, it can be seen that average bed elevations drop by about 3 to 4 feet while the thalweg drops by 4 to 5 feet. It may be recalled that these results indicate a conservative estimate due to lowered Manning's values used in the computations.

The results indicate that the average bed is lowered by 1 to 2 feet near the bridge location while the thalweg is lowered by an additional foot. The influence of the proposed conditions and proposed with pit conditions is not very significant in the reach downstream of the bridge. This can be seen by comparing the results of the existing conditions case with the proposed conditions and proposed-with-pit conditions cases. A difference of less than a foot is observed which is probably close to the order of numerical accuracy of the computations performed.

The presence of the pit in the upstream end of the model results in the following: a) deposition within the pit, b) a head-cut at upstream of the pit, and c) a tail-cut of about ½ mile in the downstream side of the pit. The influence of the pit is mostly restricted to a region about half a mile in the downstream direction. At the upstream limit of the model, the average bed-change from headcut (versus existing conditions) is about 2 feet due to the proposed borrow pit. The model was not extended further upstream because it would extend the model beyond the confluence with Martinez Wash, and the distribution of flows between the Martinez and the Hassayampa River are not known and cannot be estimated reasonably without a hydrologic model.

Wickenburg - Hassayampa Thalweg Change From Initial Condition- Long Term HEC-6T Simulation

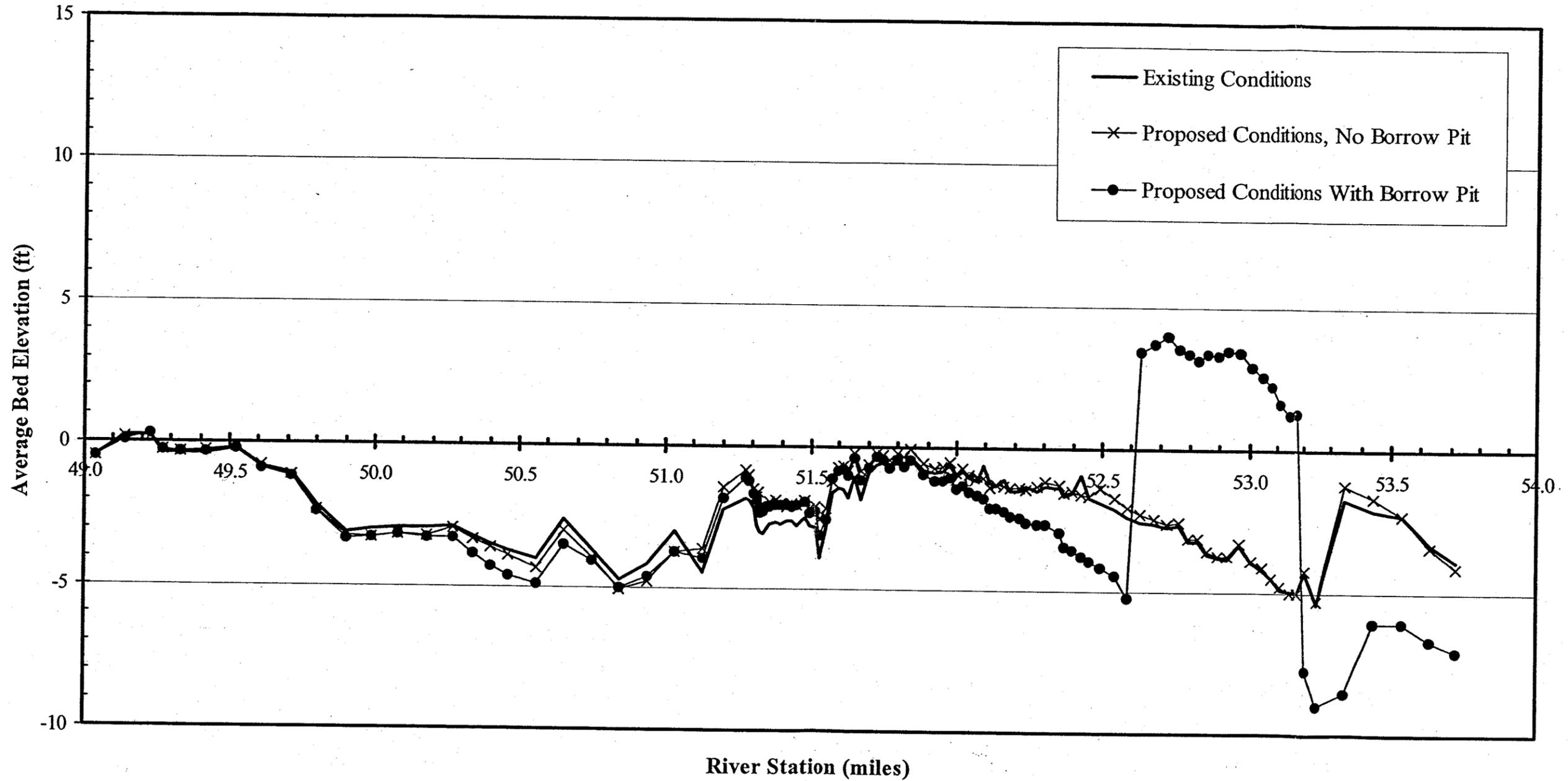


Figure 6.2. Hassayampa Sediment Models Thalweg Change

Wickenburg - Hassayampa Average Bed Change from Initial Condition- Long Term HEC-6T Simulation

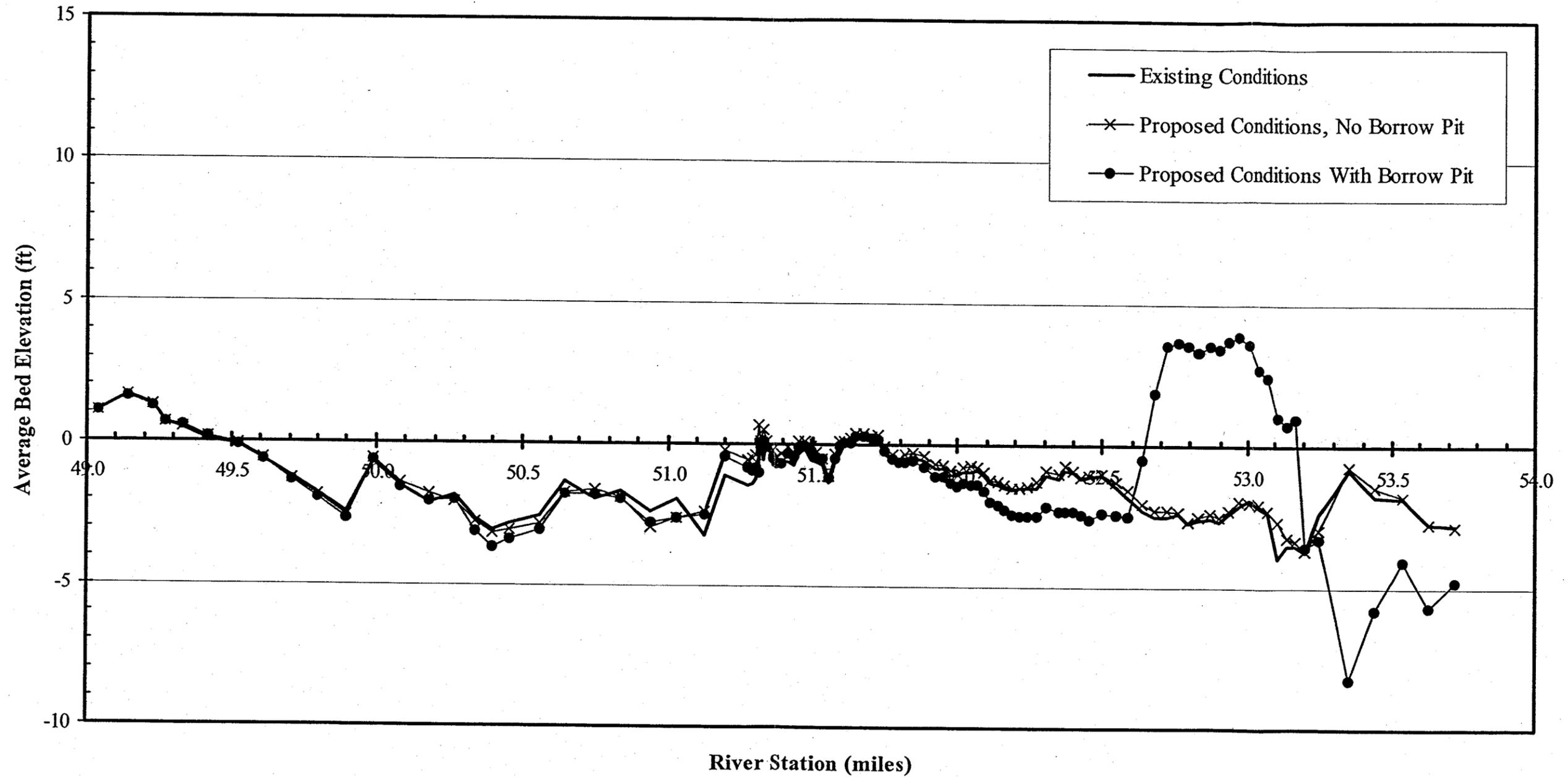


Figure 6.3. Hassayampa Sediment Models Average Bed Change

7.3.2. Hassayampa River Bend Scour

Bend scour should be considered in areas where the embankment may abut against an outer bend in the channel or a bend in the entire floodplain. This can occur due to the natural meanders of the channel moving, or due to bends already built into the proposed conditions geometry.

Zeller's (1981) Formula (Simons, Li & Associates, 1985) for bend scour was used:

$$\Delta Z_{bs} = \frac{0.0685 Y V^{0.8}}{Y_h^{0.4} S_e^{0.3}} \left[2.1 \left(\frac{\sin^2 \frac{\alpha}{2}}{\cos \alpha} \right)^{0.2} - 1 \right]$$

where:

ΔZ_{bs} = bend scour component of total scour depth (ft)

V = mean velocity of upstream flow (ft/s)

Y = maximum depth of upstream flow (ft)

Y_h = hydraulic depth of upstream flow (ft)

S_e = approach energy slope or bed slope for uniform flow (ft/ft)

α = angle formed by the projection of the channel centerline from the point of curvature to a point which meets a line tangent to the outer bank of the channel (degrees)

The relationship (Simons, Li & Associates, 1985):

$$r_c / W = (\cos \alpha) / (4 (\sin^2(\alpha/2)))$$

where:

r_c = radius of curvature to centerline of channel, (ft)

W = channel topwidth, (ft)

was used determine the ratio $\cos \alpha / \sin^2(\alpha/2)$ on the basis of r and the channel top width.

In the first significant event, the proposed borrow pit is expected to capture the channel, that is, the main channel of the river will flow through the proposed borrow pit instead of on its current course. This will happen because the proposed borrow pit was estimated to be 10 feet deeper

than the current channel and almost adjacent to it; any significant event will cause the channel to re-route through the borrow pit.

Moving downstream of the borrow pit, it appears possible that the channel could migrate over to the opposite, or west, side of the floodplain. If the channel should migrate over, that channel would then need to curve back to the west in order to go through the proposed bridge. This means an outer bend of the channel could be abutting against the bank protection. The position of the borrow pit, which is on the east side of the Hassayampa's floodplain, means that the lateral shift in the channel to the west side of the floodplain will require some distance along the channel before it can reach the other side. It was estimated that the most upstream point at which the main channel could reach the opposite side and begin its bend back to the east would be at station 147.

Examination of the natural bend radius of long arcs of the river in the project reach as well as upstream and downstream indicate that the natural radius of curvature in the meanders is about 7,000 feet. The top width in the area where the bend scour could be an issue is relatively constant, and averages about 1,500 feet. Although the natural meander radius is about 7,000, this was lowered slightly for use in the Zeller bend scour equation to be more conservative. It was decided that a bend radius of 5,000 feet should be used in conjunction with a total flow width of 1,500 feet.

To get parameters required for Zeller's bend scour equation, the velocity and energy slope were taken from cross-section 52.138, using the model which has the Manning's n in the channel equal to 0.025. This cross-section is just upstream of the reach where it is believed that bend scour could occur, and it also has a higher velocity than any of the sections nearby. The hydraulic depth of 5.33 feet and maximum channel depth of 7.72 feet was also taken from this cross-section. Using Zeller's equation with average velocity of 10.68 ft/s yields a bend scour of 2.2 feet. Although Zeller's equation specifies that mean velocity be used, the scour was also checked using the channel velocity of 14.96 ft/s, which yielded a bend scour of 2.9 feet.

Another potential for bend scour comes not from the natural meander radius of the channel but a bend in the entire floodplain which would be taking place at about station 132, which is at about cross-section 51.75. In this area both the road embankment on the right side of the channel and the bluff on the left side of the channel are both turning left. Circumscribing circles onto the channel, it appears that this bend has a radius of about 3,500 feet. When applying this bend radius and the other parameters needed for the Zeller bend scour equation, the bend scour was calculated using parameters from various cross-sections up to 2,000 feet upstream of cross-section 51.75. The bends scours thus calculated ranged from 2.6 to 2.8 feet.

Therefore, the bend scour from the bend near station 132 appeared to cause more severe bend scour than the natural bends in the river might. It was determined that the reach from downstream of station 147+30 until the confluence with Sols Wash should have a bend scour of 3.0 feet applied.

Another place where a possible bend may be taking place is through the bridge opening, right lies toward the right side of the floodplain. On the upstream side of the proposed conditions model, the new embankment constrains the right floodplain, on the downstream side there is a

bluff on the right side of the channel. Meanwhile, on the left bank, the road embankment (from the US-60 approach from the east) juts into the floodplain; on the both the upstream on the downstream side there is a considerable portion of floodplain that is obstructed by that embankment.

In this configuration, there seems to exist a potential that the flow will need to turn to get through the opening, and that the outer radius of this turn could abut the soil cement. It is difficult to tell if this effect will actually occur, but the offset of the bridge opening with respect to the floodplain opens the possibility.

It is prudent to account for this potential on the bank protection on the west side of the embankment. The region where this potential turning could take place would seem to be in the region downstream of Sols Wash. Shortly upstream of Sols Wash, it appears the effect might be possible as well, but in this reach, a bend scour of 3 feet has already been applied for reasons explained previously. In the reach downstream of Sols Wash, a bend radius of 5000 feet was applied to account for possible bending of the flow. Applying Zeller's bend scour equation for parameters obtained from various cross-sections upstream of the proposed bridge the bend scour is at a maximum if the bend begins at cross-section 51.417 or 51.435, which results in a bend scour of 4.3 to 4.5 feet. The determination was made to apply a bend scour of 4.4 feet to the reach downstream of Sols Wash and through the proposed bridge opening.

7.3.3. Antidunes

Based on the flow regime, it appeared that antidunes are possible.

The formula for antidune height is:

$$h_a = 0.14 \frac{2\pi V^2}{g} = 0.027V^2$$

where:

h_a = antidune height from crest to trough (ft)

V = channel velocity (ft/s)

g = gravitational constant, 32.2 ft/sec²

The scour depth due to antidunes is half the antidune height, or

$$\text{Antidune scour} = h_a / 2 = (0.027/V^2) / 2$$

The antidune scour averaged 1.9 feet in the reach upstream of Sols Wash, with a maximum height of 3.0. The average antidune scour was used, rounded up to the nearest foot: 2.0 feet of antidune scour was applied for the reach upstream of Sols Wash.

The abutments are 492.27 feet apart, along a line which is skewed 17 degrees to the pier groups and abutments. Most of that line is parallel with the centerline of the bridge, but as the bridge approaches the traffic circle on the west side, the centerline turns. Since the bridge is assumed to be 17 degrees skewed to the river, the skewed width (including the piers and soil cement along the abutments) as the Hassayampa River sees the bridge is $492.27 \text{ feet} * \cos(17 \text{ degrees}) = 470.76 \text{ feet}$.

Soil cement with a 1:1 side slope is to be constructed at each abutment. Under the bridge, the soil cement has 2-foot wide top shelf on the west side. For the purpose of the hydraulic model and the parameters obtained for the bridge scour calculations, the soil cement was assumed to begin just below the low-chord on the west side of the bridge. On the east side of the bridge, the top of soil cement was set at the elevation of the pedestrian underpass, at 2040.8.

7.5.2. Long Term Degradation

The long-term degradation was determined using the HEC-6T sediment transport model. The long-term simulation was performed using a hydrograph for a period of 48 years plus a hydrograph for the 100-year event. The results indicate an overall degradation of 3 feet within the project reach.

7.6. General Scour

General scour represents the scour that occurs in short time durations such as the scour due to passage of a single flood event. General scour is estimated using the Zeller equation which is valid for sand bed streams (Simons, Li and Associates, 1985). The general scour using Zeller equation for the 50 year and the superflood events are estimated as 0.4 feet and 7.5 feet respectively.

At places such as bridge crossings, the flow area reduces resulting in an increase in the average velocity as well as bed shear. This results in scour which is known as contraction scour, which is a special case of general scour. The contraction scour was calculated assuming that the entire flow in the right "overbank," upstream of the bridge, was in fact sediment-transporting channel flow. The reasoning behind this is that this right overbank area is in fact at almost the same elevation as the channel, and during a large event could transport sediment much as the channel does. This assumption leads to higher contraction scour values than just using the main channel as defined in HEC-RAS, and is therefore conservative.

The contraction scour for the 50-year and the superflood events for the Hassayampa bridge crossing are estimated as 6.1 feet and 13.3 feet respectively. Because the contraction scour values are greater than the general scour calculated using the Zeller equation, the contraction scour values govern.

7.7. Local Pier Scour

Local scour calculations at bridge piers were performed for the 50-year and superflood events using the CSU method presented in HEC-18 (FHWA, 2001). The effective pier width was increased by 4 feet to accommodate the presence of debris accumulation. Due to the presence of

Duplicate Effective Model

HEC-RAS Version 3.1 November 2002
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X   X  XXXXXX   XXXX   XXXX   XX   XXXX
X   X X         X  X   X  X   X X   X
X   X X         X         X  X   X  X   X
XXXXXXXX XXXX   X         XXX XXXX   XXXXXX   XXXX
X   X X         X         X  X   X  X   X
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PROJECT DATA

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Project in English units

Project Description:
& R

PLAN DATA

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Geometry Title: Existing Conditions Feb 24
Geometry File : r:\Phoenix\Projects\AZ03152\04\Technical\Drainage\West
Consultants\wickenburg.g01

Flow Title : Existing Cond DS FEMA 51.13 Sec flow bal
Flow File : r:\Phoenix\Projects\AZ03152\04\Technical\Drainage\West
Consultants\wickenburg.f02

Plan Summary Information:

Number of:	Cross Sections	=	78	Multiple Openings	=	0
	Culverts	=	0	Inline Structures	=	0
	Bridges	=	1	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data

Equal Conveyance	=	True
Left Offset	=	0
Right Offset	=	0

(Digital HEC-RAS Model on CD in Appendix A.16)

Proposed Condition Model

HEC-RAS Version 3.1 November 2002
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X   X XXXXXX   XXXX   XXXX   XX   XXXX
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PROJECT DATA

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Project File : wickenburg.prj
Run Date and Time:

Project in English units

Project Description:
& R

PLAN DATA

Plan Title:
Plan File :

Geometry Title: Proposed Feb 14
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Consultants\wickenburg.g79

Flow Title : Existing Cond DS FEMA 51.13 Sec flow bal
Flow File : r:\Phoenix\Projects\AZ03152\04\Technical\Drainage\West
Consultants\wickenburg.f02

Plan Summary Information:

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Culverts =	0	Inline Structures =	0
Bridges =	2	Lateral Structures =	0

Computational Information

Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

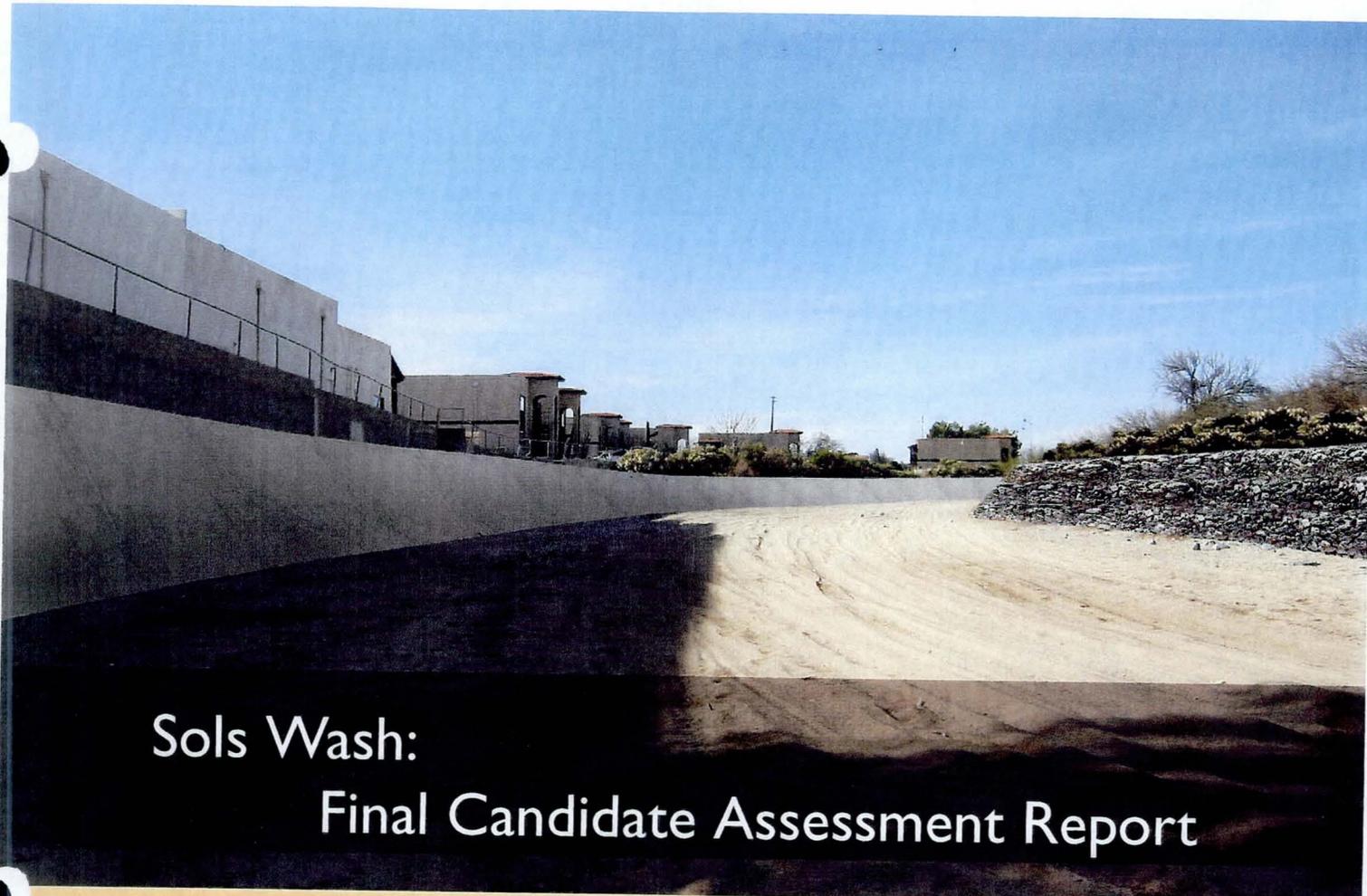
Encroachment Data

Equal Conveyance = True
Left Offset = 0
Right Offset = 0

(Digital HEC-RAS Model on CD in Appendix A.16)



A.6 Sols Wash Candidate Assessment Report



Sols Wash:
Final Candidate Assessment Report

Monday, August 16th, 2004



Prepared For:
Flood Control District of Maricopa County
FCD 2002C030

Prepared By:



3747 E. Grove Street Phoenix, AZ 85040 Phone: 602-454-0402 Fax: 602-454-0403

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Sols Wash: Final Candidate Assessment Report
FCDMC call number : CDA343.2

Date:

August 2002

Description:

Analyzes improvements to Sols Wash to eliminate flooding and recommends a design alternative.

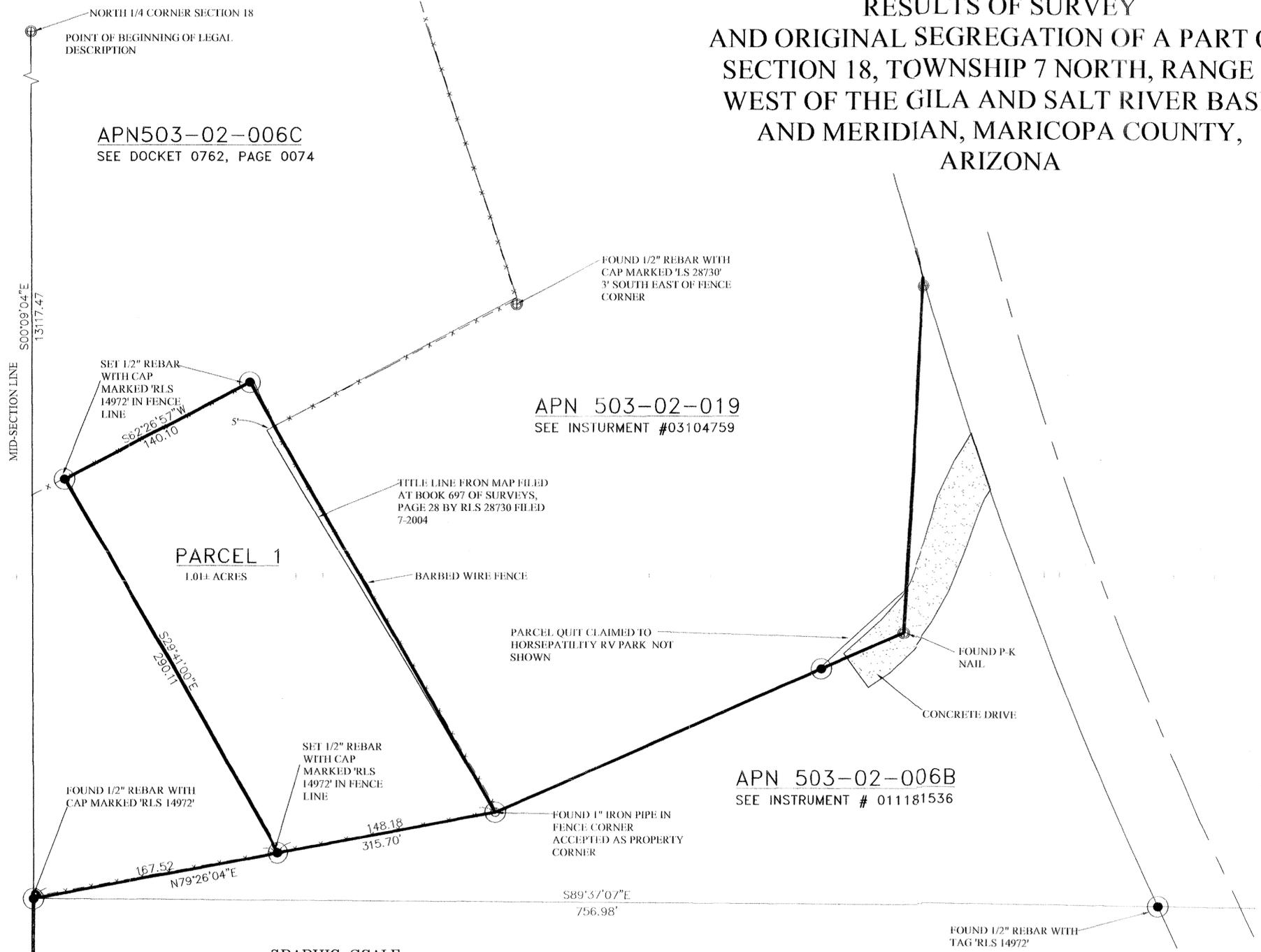
Type of Data:

Updated Hec-Ras model of study area and preliminary alternative Hec-Ras models.



A.7 Horspitality RV Park Information

**RESULTS OF SURVEY
AND ORIGINAL SEGREGATION OF A PART OF
SECTION 18, TOWNSHIP 7 NORTH, RANGE 4
WEST OF THE GILA AND SALT RIVER BASE
AND MERIDIAN, MARICOPA COUNTY,
ARIZONA**



**LEGAL DESCRIPTION
PARCEL 1**

A portion of the Northwest quarter of the Northeast quarter of Section 18, Township 7 North, Range 4 West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, more particularly described as follows:
Commencing at the North quarter corner of said section 18, a GLO Brass Cap set in a fence corner;

Thence South 00°09'04" East a distance of 1317.47', (record South, 1320 feet) along the mid section line of said Section 18 to a 1/2" rebar with yellow plastic cap marked 'RLS14972, marking the Southwest corner of the Northwest quarter of the Northeast quarter of said Section 18;

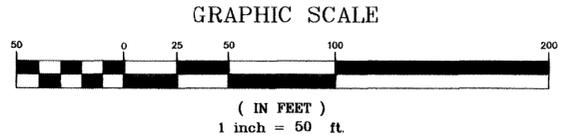
Thence North 79°26'17" East (record North 79°40' East) a distance of 167.52 feet to a 1/2" rebar with yellow plastic cap marked 'RLS14972, the **TRUE POINT OF BEGINNING**;

Thence continuing North 79°26'17" East a distance of 148.18 feet to a 1" iron pipe in a fence corner;

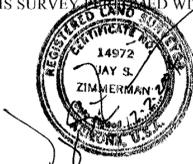
Thence North 29°41'00" West (record North 30°35' West) a distance of 333.44 feet to a 1/2" rebar with yellow plastic cap marked 'RLS 14972 set in a fence corner;

Thence South 62°26'57" West a distance of 140.10 feet to a 1/2" rebar with yellow plastic cap marked 'RLS14972';

Thence South 29°41'00" East a distance of 290.11 feet to the true point of beginning.



SURVEYORS NOTES:
SURVEYED NOVEMBER 2004
BASIS OF BEARINGS IS GEODETIC (WGS-84) DETERMINED BY GPS OBSERVATION
THIS SURVEY WAS CONDUCTED WITHOUT THE BENEFIT OF A TITLE REPORT



GPSND
LAND SURVEYING
TOPOGRAPHIC MAPPING
P.O. BOX 188
MORRISTOWN, AZ. 85342
928.671.1100
(FAX) 623.388.0561
jay@gpsnd.com

NOTES:

NOTE 'A' AN UNRECORDED MAP BY CADIMUS GOSS PREPARED IN THE LATE 1970S MAKES REFERENCE TO THIS NAIL, AND IS SHOWN ON NO RECORDED MAP.

NOTE 'B' THIS NAIL IS NOTED ON AN ALTA SURVEY BY MEAD RECORDED AT BOOK 600 OF MAPS, PAGE 32 AS THE HISTORICAL SOUTHWEST CORNER OF NORTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 18. RECORDED 08-2002

NOTE 'C' THIS NAIL IS ALSO REFERENCED AS THE 1/8 CORNER ON A RESULTS OF SURVEY BY CENTERLINE OFFSET INC RECORDED AT BOOK 190, PAGE 19. RECORDED 01-1999

NOTE 'D' NORTHWEST CORNER OF THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 18. SET IN FENCE CORNER USING DEED TIE TO A FOUND 1" IRON PIPE. ALL MONUMENTS TO THE SOUTH IN THIS SECTION ARE IN THE RIVER BOTTOM AND ARE LOST.

NOTE 'E' CALLED AS ON THE NORTHEASTERLY RIGHT OF WAY LINE OF U.S. 60 ON 490-19

NOTE 'F' ADOT BRASS CAP SET IN CONCRETE MARKED STA 936+02.15 60FT. OUT 1958

NOTE 'G' 1" IRON PIPE IN FENCE CONER ACCEPTED AS PROPERTY CORNER

NOT ALL EASMENTS SHOWN

SET 3/8" REBAR IN OLD FENCE CORNER SEE NOTE 'D' TIE TO NORTH 1/4 CORNER OF SECTION 18
N00°07'55"E, 1321.88'

RECORD OF SURVEY

OF THE PARCELS DESCRIBED AT DOCKET 20011181536 AND 20041094693 SITUATED IN THE NORTHEAST QUARTER OF SECTION 18, TOWNSHIP 7 NORTH, RANGE 4 WEST OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA

CERTIFICATION:

THIS IS TO CERTIFY THAT THIS SURVEY AND MONUMENTATION OF THE ABOVE DESCRIBED PARCEL WAS MADE BY ME, AND IS BASED FROM AN ACTUAL FIELD SURVEY. THE MONUMENTS SHOWN AS FOUND WERE FOUND; THE MONUMENTS SHOWN AS SET WERE SET. THIS PLAT MEETS THE REQUIREMENTS OF ARS-33.105.

JAY & ZIMMERMAN R.L.S. 14972

PARCEL 2

76,981 SQ.FT.
1.77± ACRES

PARCEL 1 DOCKET 200120011181536

That part of the Southwest quarter of the Northeast quarter of Section 18, Township 7 North, Range 4 West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, lying southwesterly of the Southwest right of way line of U.S. 60, the Wickenburg-Phoenix Highway described as follows:

Beginning at the Northwest corner of said Southwest quarter of the Northeast quarter of Section 18;
Thence South 89°58' East along the North line thereof a distance of 752.23 feet to a point on the Southwesterly right of way line of U.S. 60, the Wickenburg-Phoenix Highway;
Thence southeasterly along said Southwesterly right of way line a distance of 272.43 feet, said right of way line being a curve to the left with a radius of 2917.79 feet to the center line of concrete box culvert;
Thence South 55°22' West 1069.24 feet to a point on the West line of said Southwest quarter of the Northeast quarter of Section 18;
Thence North 00°05' East along said West line a distance of 850.00 feet to the point of beginning.

PARCEL 2 DOCKET 200120011181536

That part of the Northwest quarter of the Northeast quarter of Section 18, Township 7 North, Range 4 West of the Gila and Salt River Base and Meridian, Maricopa County

Arizona described as follows:
Beginning at the Northwest corner of the Northwest quarter of the Northeast quarter;
Thence East 410 feet;
Thence South 11° East 525 feet;
Thence South 13°00' East 394 feet to a point on the Southerly boundary of the Wickenburg-Phoenix Highway and the True Point of Beginning;
Thence South 03°13' West 242 feet;
Thence South 66°35' West 300 feet;
Thence South 79°40' West 315.9 feet to the Southwest corner of the Northwest quarter of the Northeast quarter;
Thence North 89°58' East 738 feet;
Thence Northwesterly along the Southwesterly right of way of said Highway, 440 feet to the True Point of Beginning.

PARCEL 3 DESCRIBED IN DOCKET 20041094693

A parcel of land located in Section 18, Township 7 North, Range 4 West of the Gila and Salt River Base and Meridian, Maricopa County, ARIZONA, described as follows:

Beginning at the intersection of the Westerly right-of-way line of U.S. Highway 60/89, the Phoenix-Wickenburg Highway, with the North line of the Southwest quarter of the Northeast quarter of said Section 18;
Thence southeasterly along said Westerly right-of-way line of U.S. 60/89 a distance of 272.43 feet to the True Point of Beginning of the parcel herein described;
Thence South 55°22' West 1069.94 feet;
Thence South 00°05' West 600 feet;
Thence North 27°20'10" East 668.60 feet;
Thence South 32°08'27" East 75.00 feet;
Thence North 47°51'33" East 75.00 feet;
Thence North 32°08'27" West 75.00 feet;
Thence North 47°51'33" West 175.00 feet to the True Point of Beginning.

NOTES:

BASIS OF BEARINGS IS GEODETIC (WGS 84) DETERMINED BY GPS OBSERVATION
ADD DISTANCES MEASURED THIS SURVEY
SURVEYED APRIL, 2003, REVISED NOVEMBER 2004

© FOUND 1/2" REBAR NOT TAGGED OR AS NOTED

● SET 1/2" REBAR WITH CAP MARKED 'RLS 14972'

LINE TABLE

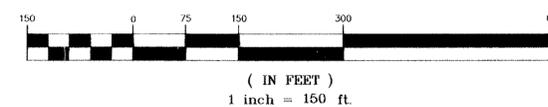
LINE	LENGTH	BEARING
L1	75.00	N42°19'19"W
L2	75.00	S47°40'41"W
L3	75.00	N42°19'19"W
L4	85.00	N34°38'00"W
L5	175.00	S47°40'41"W
L6	75.00	S47°40'41"W

CURVE TABLE

CURVE	LENGTH	RAD[US	DELTA
C1	264.81	2914.79	5°12'19"
C2	220.66	2914.79	4°20'15"
C3	690.69	2914.79	13°34'37"

PROPERTY OWNER
HORSEPATILITY R.V. PARK
PAUL & JANICE SULLIVAN OWNERS

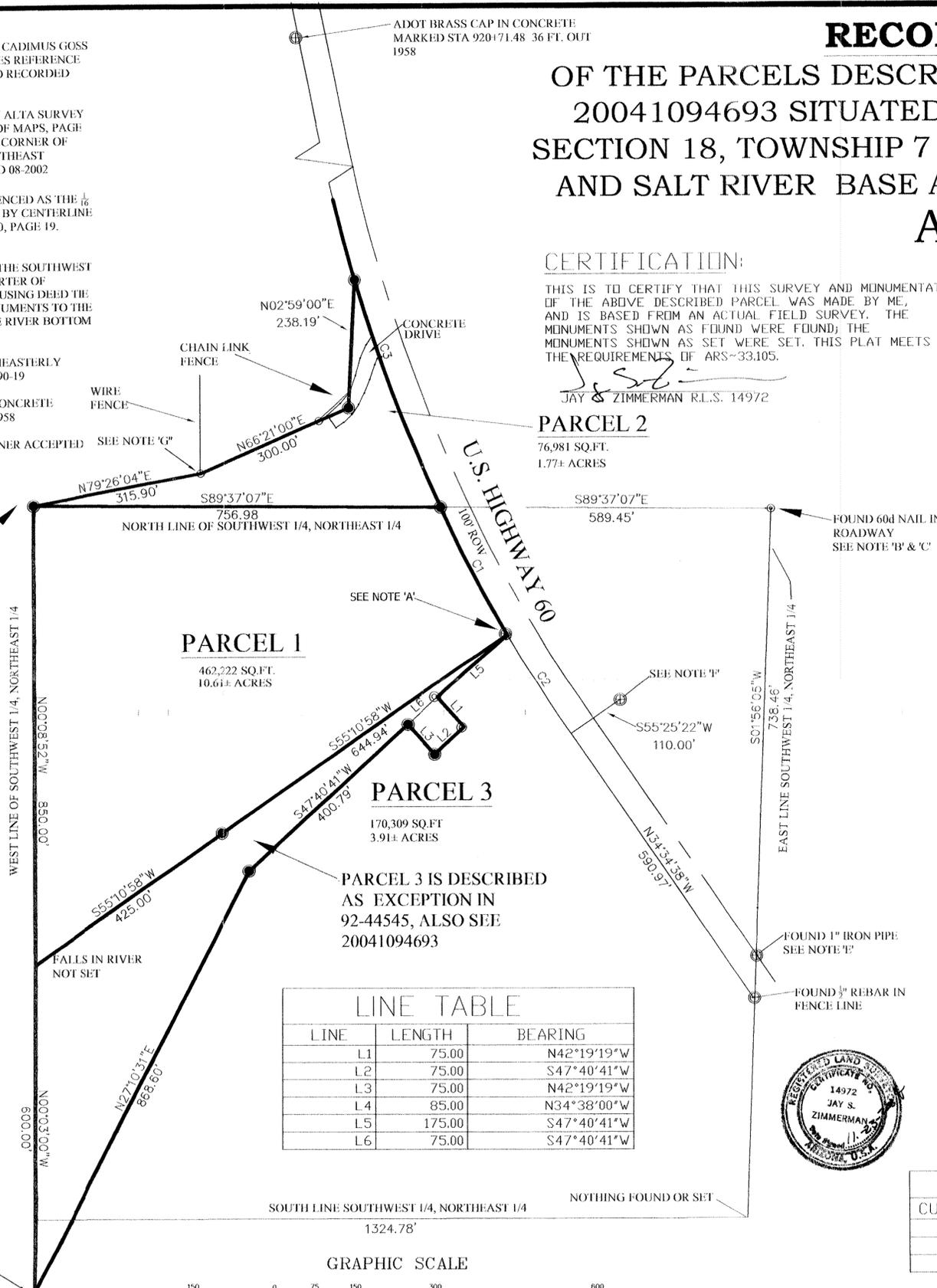
GPSND
LAND SURVEYING
TOPOGRAPHIC MAPPING
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MORRISTOWN, AZ. 85342
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(FAX) 623.388.0561
jay@gpsnd.com



BOOK 714 PAGE 45
OFFICIAL RECORDS OF
MARICOPA COUNTY RECORDER
HELEN PURCELL
2004 - 1375136

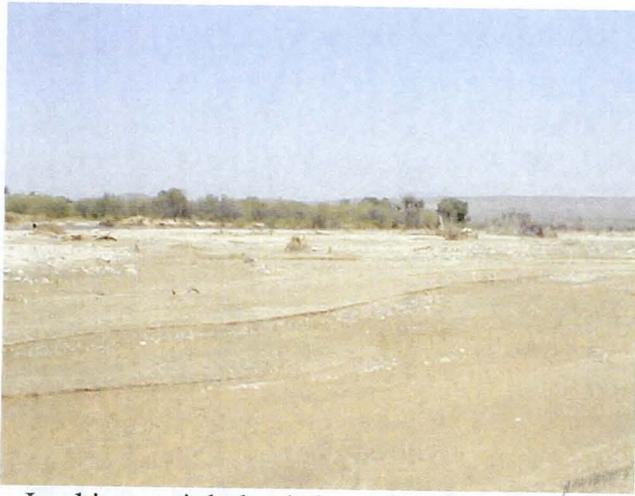
11/23/2004 01:10 PM
DRAFTING

FALLS IN RIVER
NOT SET





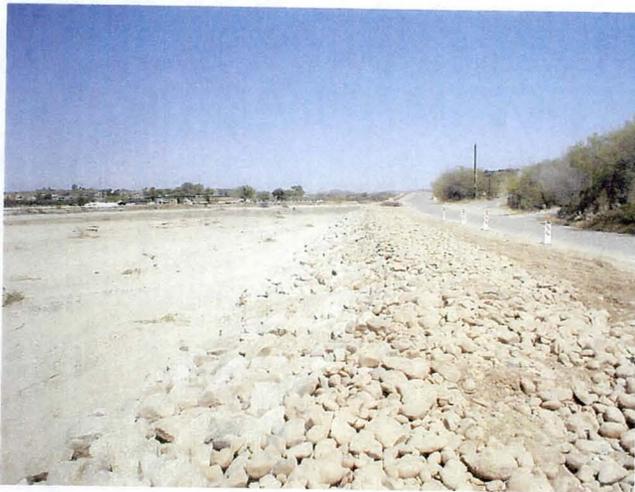
A.8 April 18th Field Trip Photos



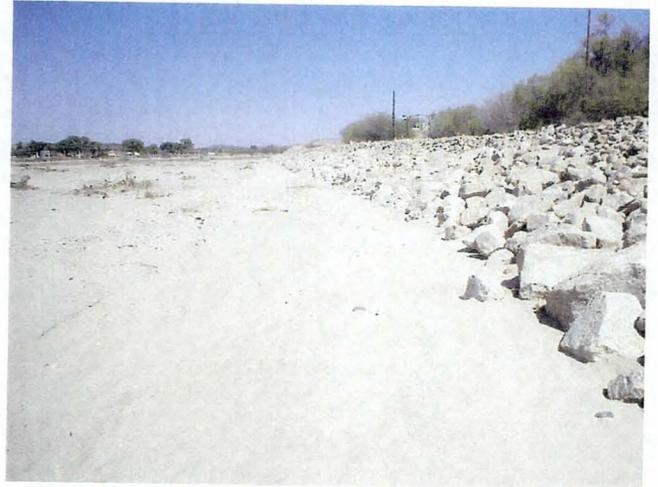
Looking at right bank from river bottom,
upstream of bridge



New bank protection on east bank, looking
downstream



East bank protection looking upstream



East bank protection looking upstream, from
river bottom



East bank protection looking downstream



Looking at the east bank protection from the
riverbed



East conveyance of Hassayampa River



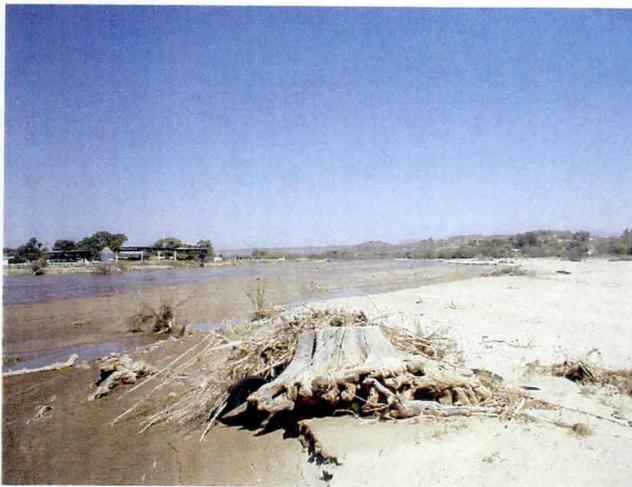
Hassayampa River upstream of bridge



Middle of river, upstream of bridge



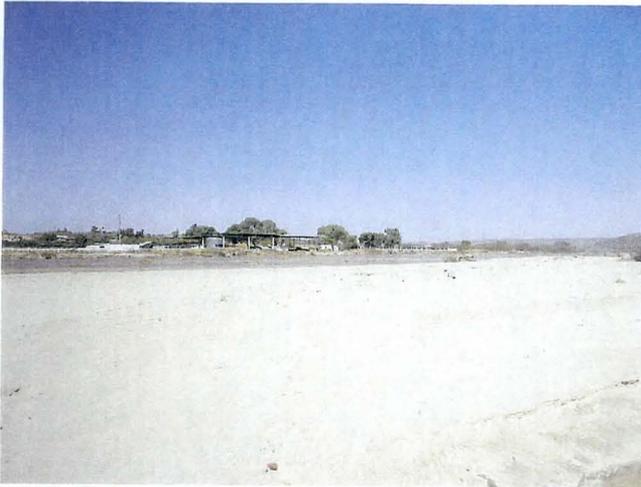
West conveyance of Hassayampa upstream of bridge



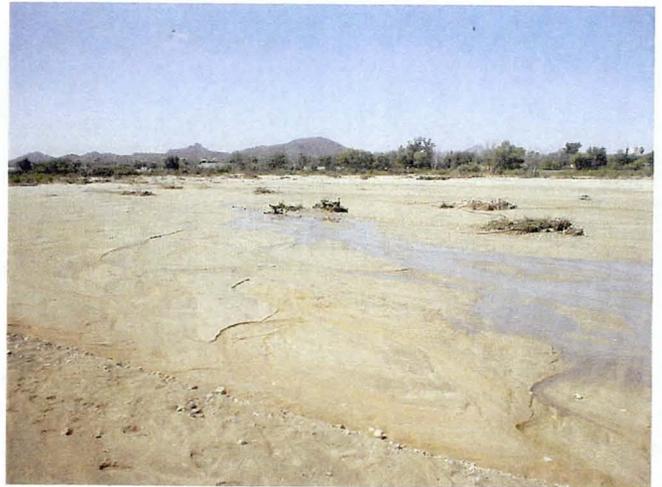
Looking at property of east bank, upstream of bridge



East portion of Hassayampa



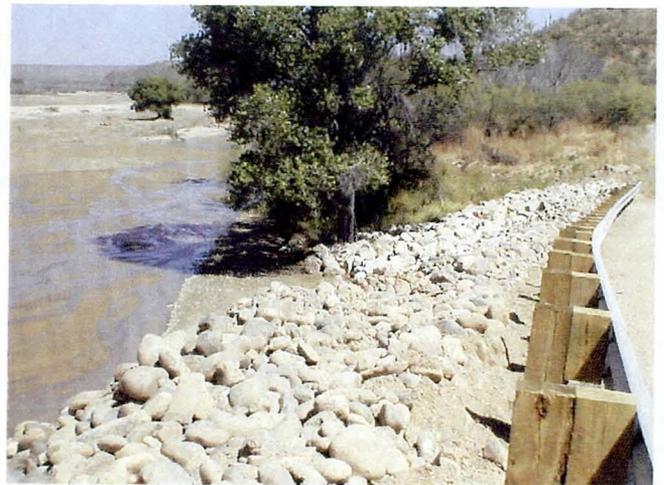
Looking upstream towards the west bank



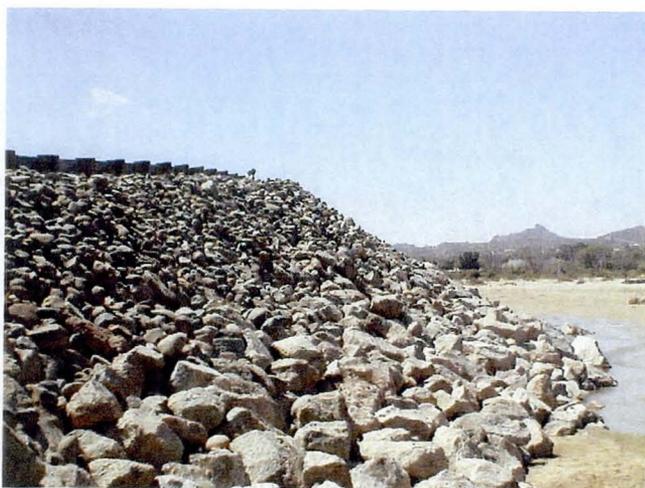
East section of Hassayampa



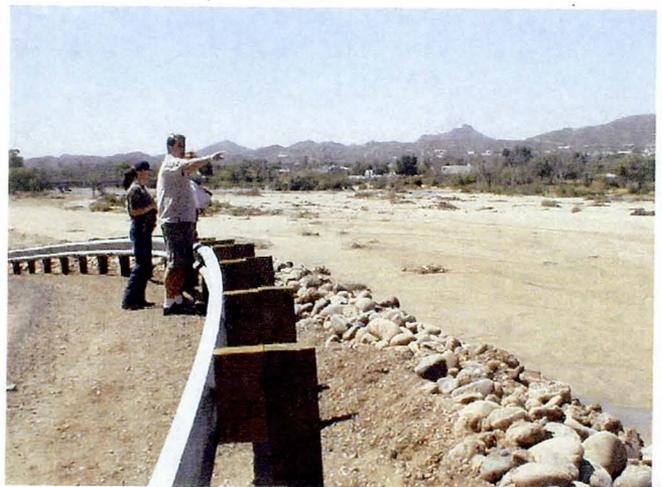
Looking at east bank protection from the riverbed



East bank protection by the side of the Jack Burden Rd.



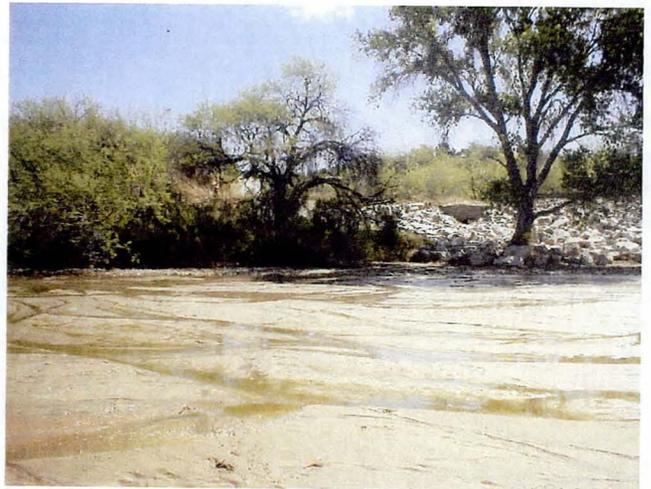
Upstream end of the east bank protection



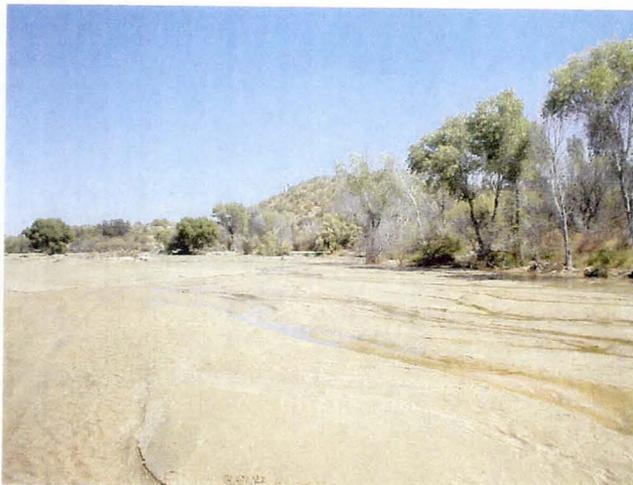
Looking downstream towards the west bank from the Jack Burden Rd.



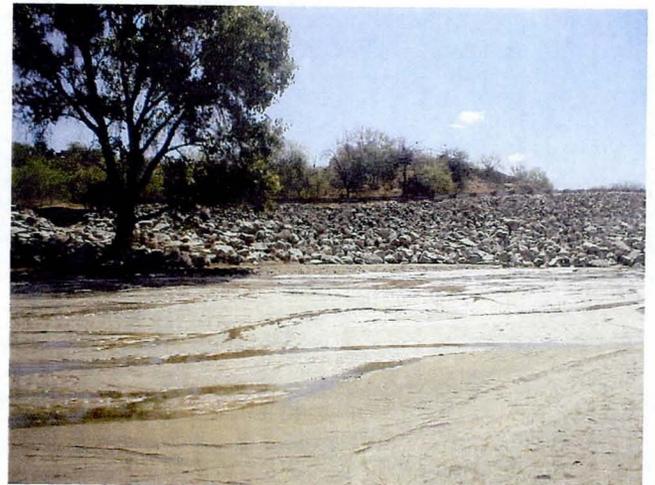
Bank protection on the side of Jack Burden Rd



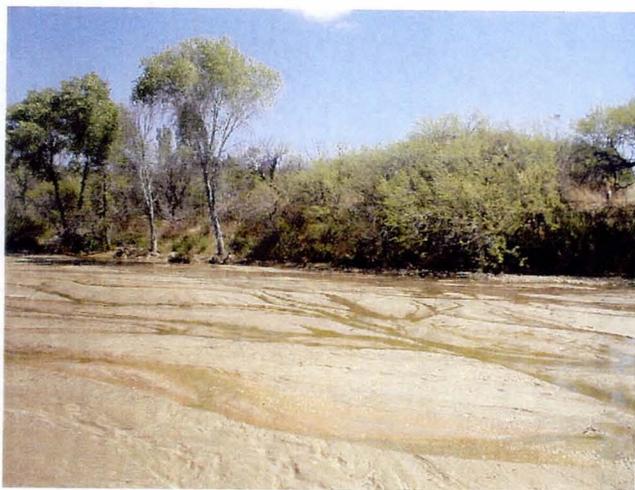
East bank of Hassayampa



Just upstream of bank protection on east side of Hassayampa



East bank from the riverbed



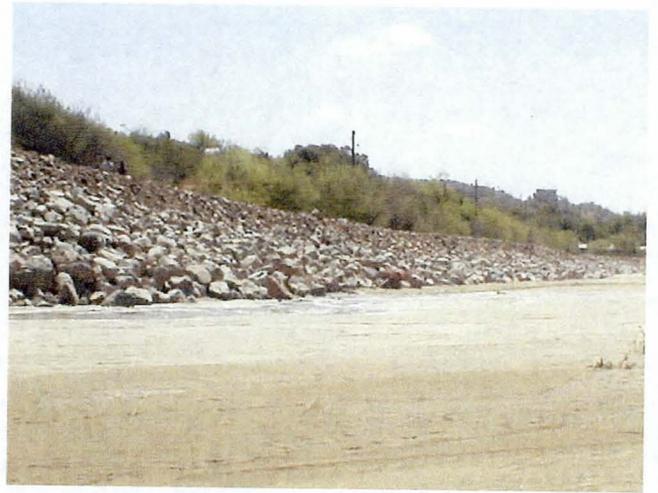
East bank upstream of bank protection



Looking downstream from the riverbed



Looking towards the west bank



The riverbed looking towards east bank



Property of west bank upstream of bridge



East bank of Hassayampa



Property of west bank upstream of bridge



The riverbed looking towards east bank



The riverbed, looking towards the east bank to the mobile park



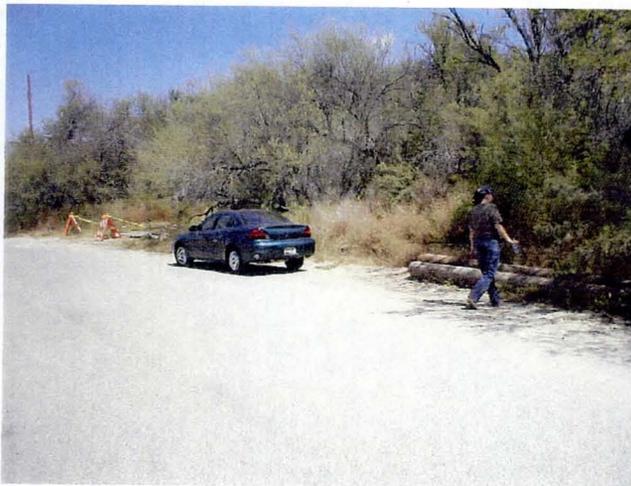
Damaged well on the west side of Jack Burden Rd.



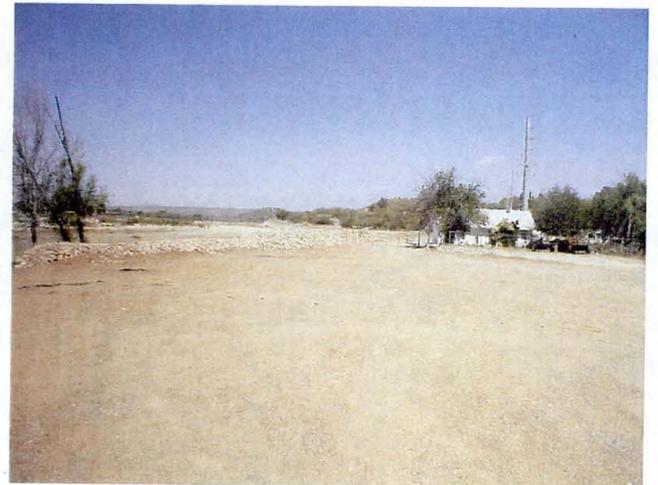
Jack Burden Rd. going towards the mobile park



Between Jack Burden Rd & the Hassayampa, just upstream of bridge



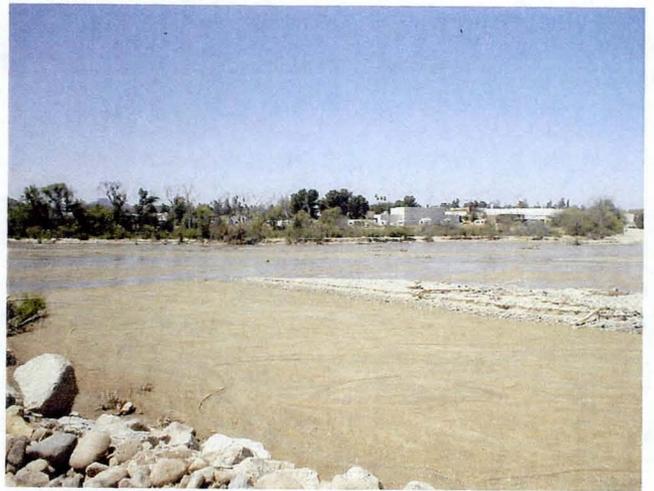
Electrical pole damaged along Jack Burden Rd.



Looking upstream between Jack Burden Rd and the river



Looking towards the west bank, damaged jeep in river bed



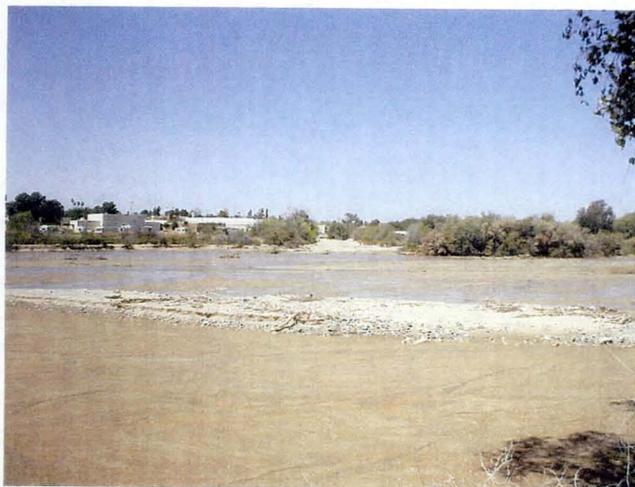
Looking towards the west bank



Looking upstream from the east bank protection, just north of the bridge



Bank protection and fill on west bank



Looking across the river just upstream of bridge



Damaged trees, accumulation of silt upstream of bridge



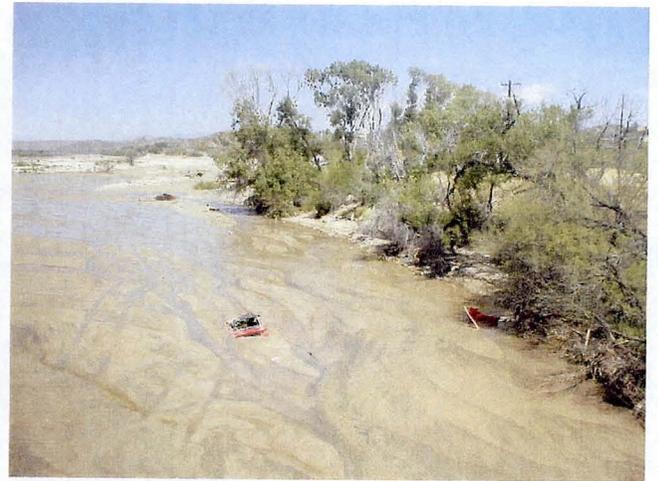
Debris from flood upstream of bridge



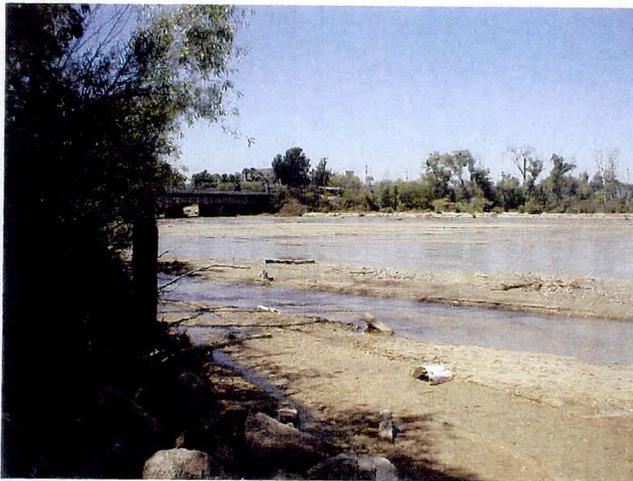
Looking across river at the bridge



Debris from the flood just upstream of bridge



Washed away car, looking upstream on bridge



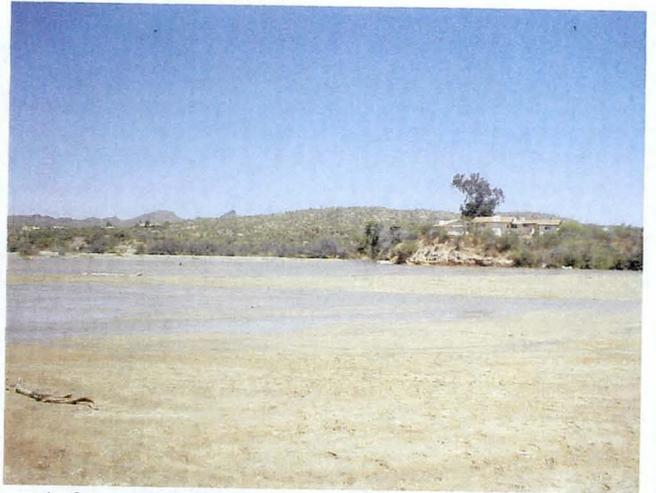
Looking across river, bridge in view



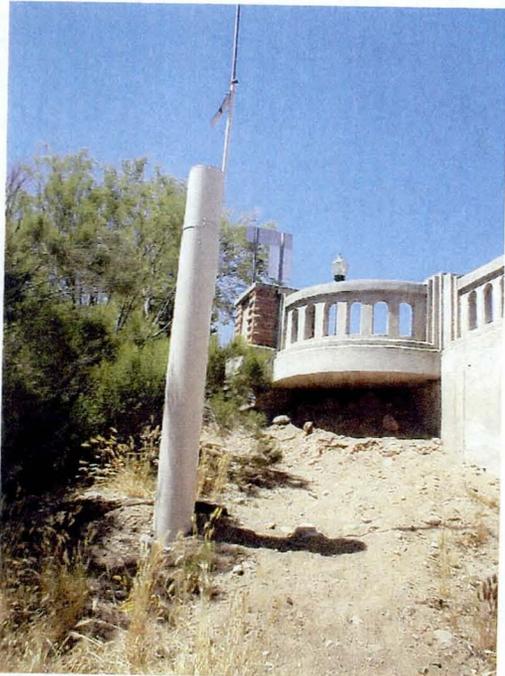
Looking upstream on the bridge, Sols Wash sediment area



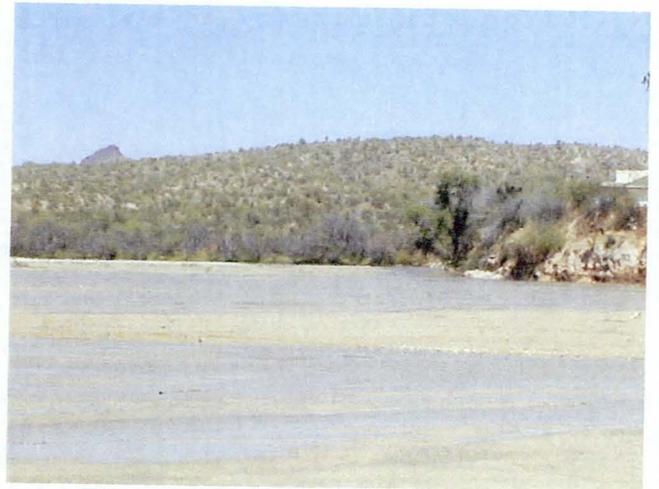
Raised riverbed (silt, debris), under bridge



A few miles upstream of bridge in river



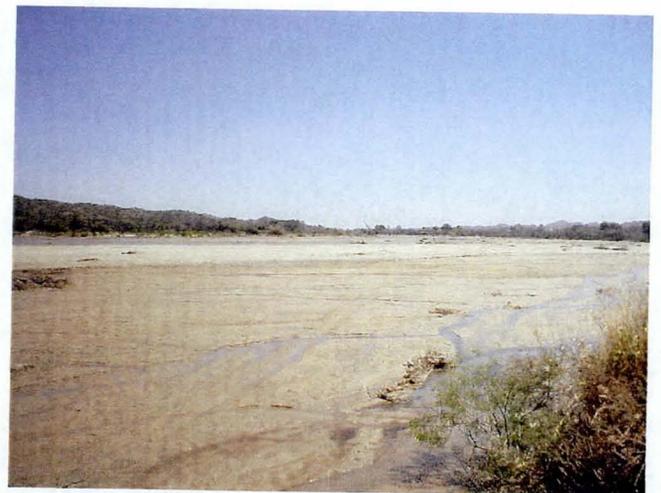
FCDMC Gage, downstream side of bridge



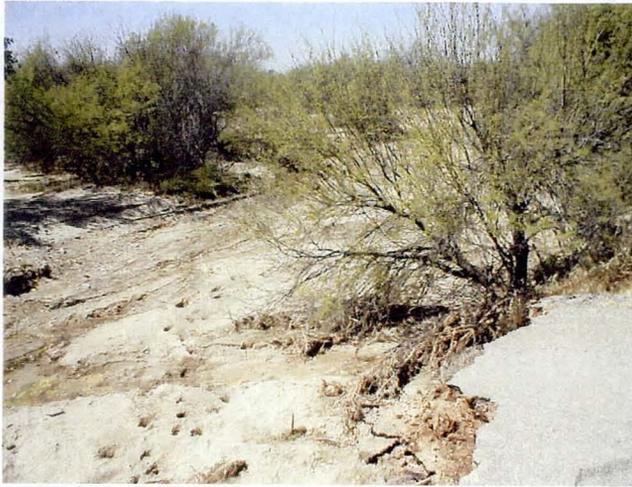
A few miles upstream of bridge in river



A few miles upstream of bridge in river



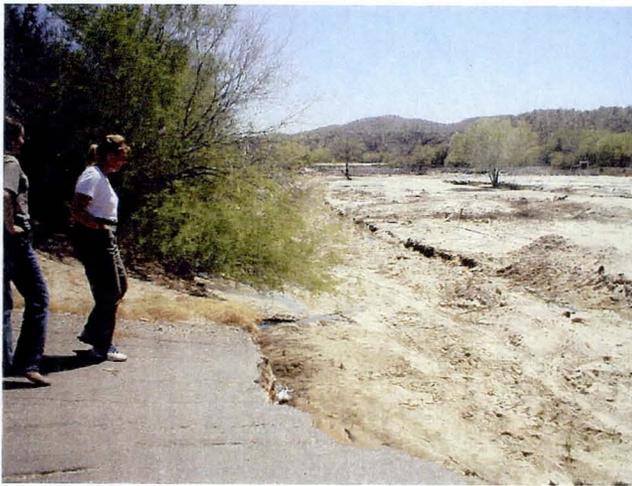
Looking downstream



Damaged road at Horspitality RV park.



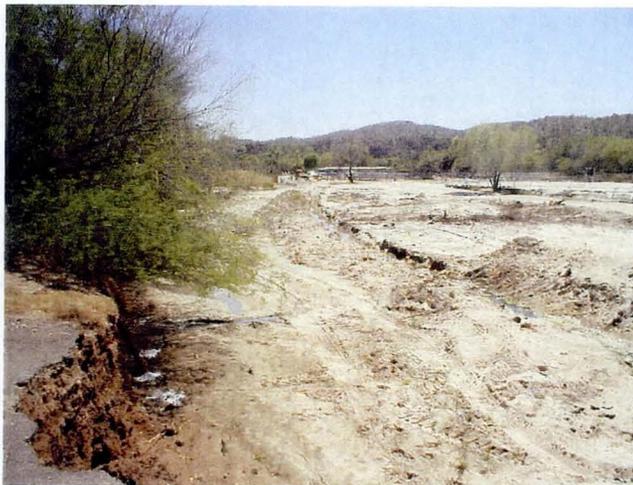
Damaged road at Horspitality RV Park



Damaged road at Horspitality RV park that used to lead to the horse pens



Temporary berm built behind Horspitality RV Park



Where the horse pens used to be, behind Horspitality RV park



Looking towards Horspitality RV park on the temporary berm



Temporary berm built behind Horspitality RV Park



Debris in watercourse just upstream of Horspitality RV Park



Horse pens at Horspitality RV park



Upstream of Horspitality RV Park in river



Flood debris, area behind Horspitality RV Park



Debris in river just upstream of Horspitality RV park



Looking towards Horspitality RV Park from river



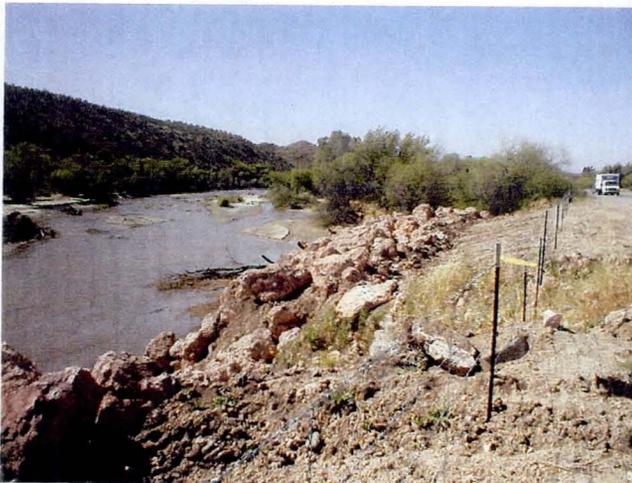
Rip-rap protection along US 60 by ADOT



Looking downstream towards temporary berm



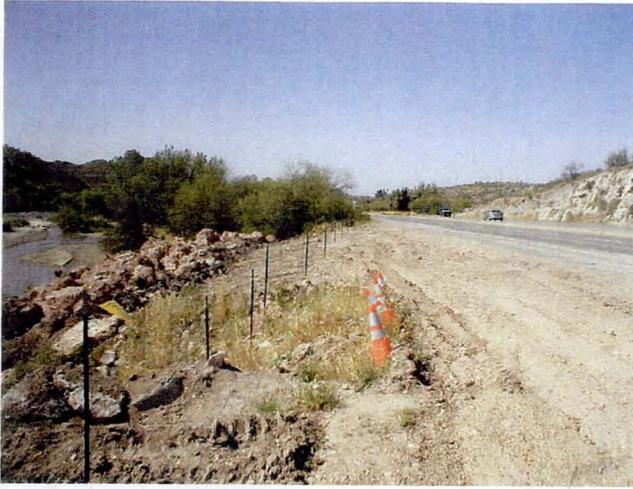
Rip-rap protection along US 60 by ADOT



Rip-rap protection along US 60 by ADOT



Rip-rap protection and ABC fill along US 60 by ADOT



Rip-rap protection temporary fence, and
ABC fill along US 60 by ADOT



A.9 US 93 Bridge Over Hassayampa River As-Built Drawings

FED. ROAD DIST. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	F022-2(1)	1	27	
7	ARIZ.	Non-F-32-200A	1	15	

PLANS DIVISION

JUN 13 1961

FILE COPY

737

UPDATED 737-110.53

MAR 20 1974

STATE OF ARIZONA
STATE HIGHWAY DEPARTMENT

PLAN AND PROFILE OF PROPOSED
STATE HIGHWAY
WICKENBURG - PHOENIX HIGHWAY

MARICOPA COUNTY

Non-F 022-2(6)1A

AS BUILT

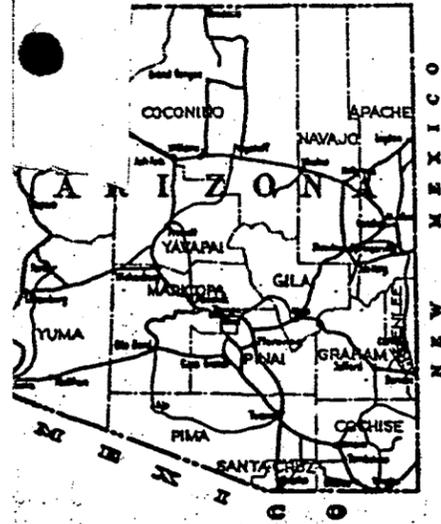
PLANS DIVISION

JUN 13 1961

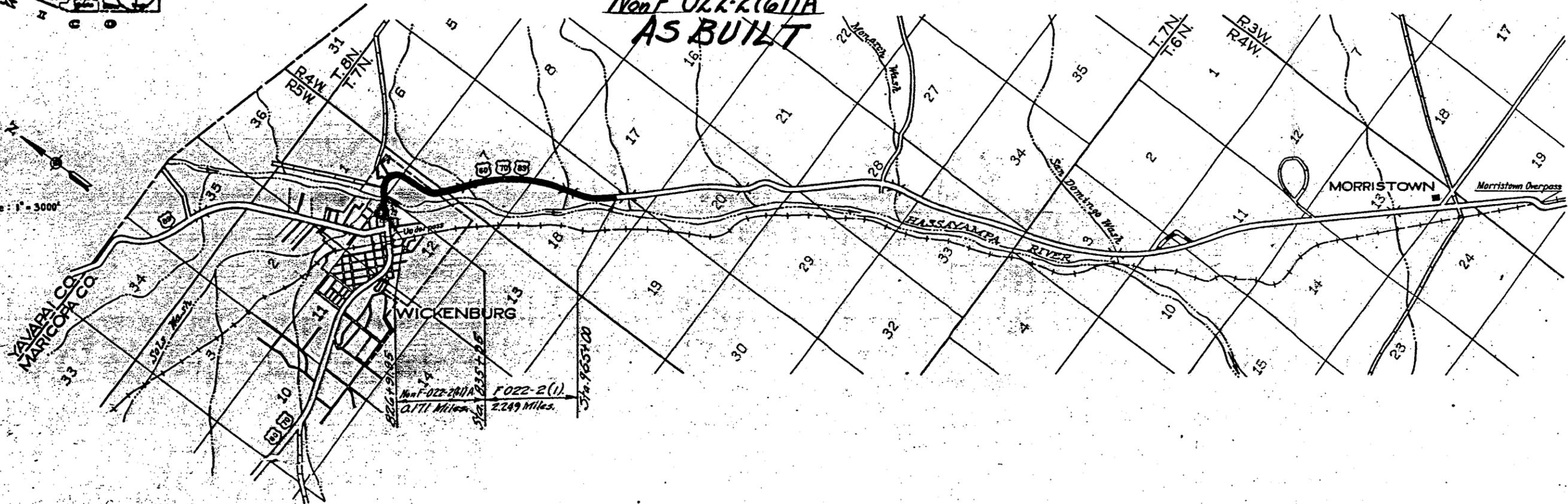
FILE COPY

UTAH

NEW MEXICO



Scale: 1" = 3000'



CONVENTIONAL SIGNS

- STATE AND NATIONAL LINE
- COUNTY LINE
- TOWNSHIP OR BOROUGH
- RANGE LINE
- SECTION LINE
- SECTION CORNER
- R/W LINE MARKER
- TREES AND SHRUBS
- CULVERT, CONCRETE
- CULVERT, PIPE
- DROP INLET
- CATTLE GUARD
- POWER POLE
- TELEPHONE POLE
- CHANNEL OR DITCH
- DIKE
- GUIDE POST
- BRIDGE
- GRADE LINE
- GROUND LINE
- SECTION CORNER (BOUND)
- R/W LINE MARKER
- TREES AND SHRUBS

ARIZONA STATE HIGHWAY COMMISSION
APPROVED WILLIAM E. WILLEY
STATE HIGHWAY ENGINEER

DATE 6/13/61 DEPUTY STATE ENGINEER

APPROVED

DATE ASST. STATE ENGINEER

DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

RECOMMENDED FOR APPROVAL DATE

DIVISION ENGINEER

APPROVED

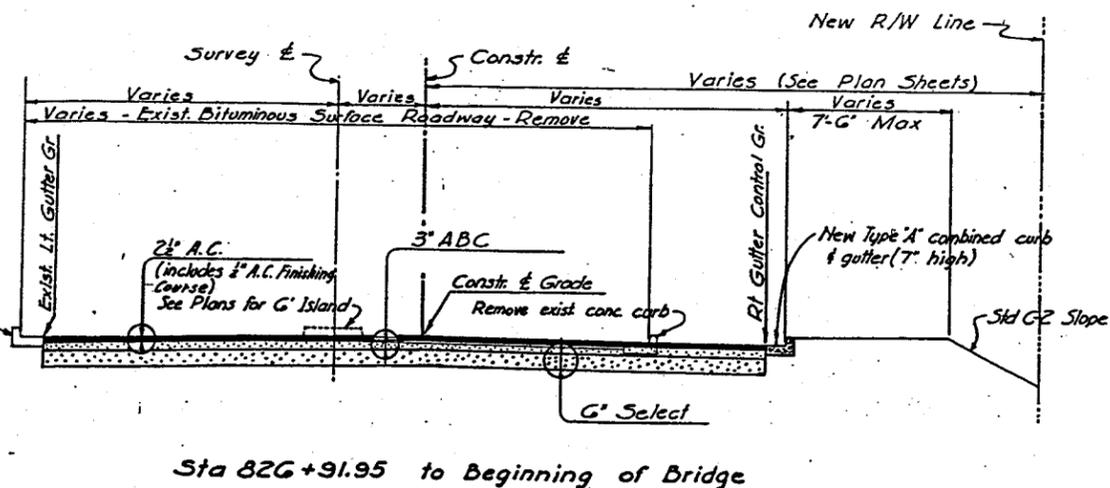
DATE

REGIONAL ENGINEER

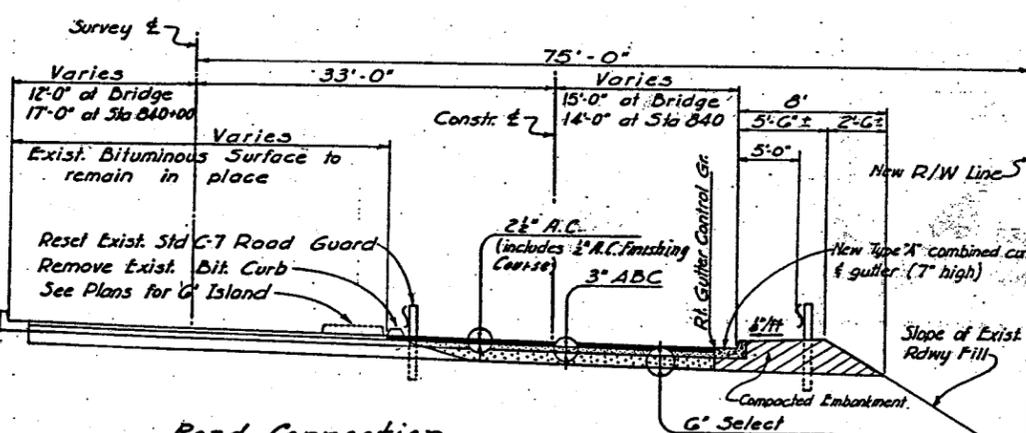


FED. ROAD DIV. NO.	STATE	PROJECT	SHEET NO.	TOTAL SHEETS	AS B
7	ARIZ.	NonF-022-2(0)A	2	15	M

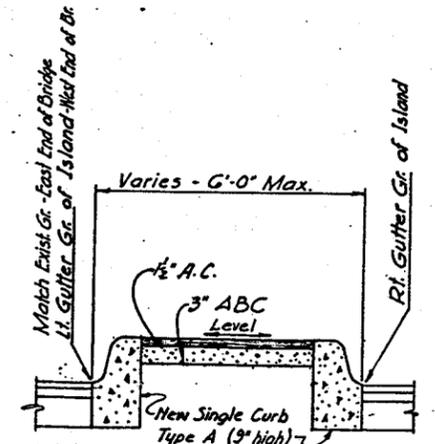
HOFFMAN-MILLER ENGRS. INC.
FOR THE CONSULTING ENGINEER
DESIGN: DRAWN: W.L.M. CHK'D: H.I.



Sta 826+91.95 to Beginning of Bridge



Road Connection
End of Bridge to Sta 840+00
TYPICAL SECTIONS



TYPICAL SECTION OF
CENTER DIVIDING ISLAND

RIGHT OF WAY MARKERS
3 Required. Std. C-1

CONCRETE CURB and GUTTER

- 797 Lin. Ft. New Combined Curb & Gutter Type 'A' (7" high) Std. C-20
- 399 Lin. Ft. New Single Curb Type 'A' (9" high) Std. C-20
- 75 Lin. Ft. Concrete Valley Gutter (4") Std. C-20

CONCRETE SIDEWALK

- Rt Sta 826+90 to Sta 831+00
- Rt Sta 835+82.78 to End of Dado
- 2170 Sq. Ft. New 5" Conc. Sidewalk Std. C-20
- Lt Sta 835+90
- 96 Sq. Ft. New Conc. Sidewalk Std. C-20.

CATCH BASIN

- Rt. Sta 827+84 New No. 3 Catch Basin
- Standard C-27-1

ROAD GUARD

- 400 Lin. Ft. Required Type 'A' & 'B'
- Standard C-7-1

STRUCTURE OVER 20' CLEAR SPAN

- Sta 830+99.62 to Sta 835+82.78
- New G-80' Spans - Steel Girder Bridge.
- See Bridge Sheets

RESET MANHOLE FRAME & COVER

- Rt. Sta 827+57 Reset Exist. Manhole Frame & Cover to New Grade

RESET SURVEY MONUMENT FRAME & COVER

- Rt Sta 828+85 Reset Exist. Monument Frame & Cover to New Grade

NEW C.M.P. & R.C.P.

- Sta 827+53 New 12" x 10" Stub for catch basin. Type I Install, C Bedding, Class III R.C.P.
- Sta 831+ Exist. 36" R.C.P. Extend 3', Class III R.C.P.
- Rt Sta 835+ Exist. 24" C.M.P. Extend 8', 14 ga.

LENGTH OF PROJECT

Sta 826+91.95 to Sta 828+92.33 = 200.38'
Sta 828+91.80 to Sta 835+95 = 703.60'
Total length Proj. NonF-022-2(0)A = 903.98' or 0.171 Mi.
Mile Post #110.45 to Mile Post #110.62

GENERAL NOTES

- All encroachments within Right of Way to be removed by Order of State.
- Engineer shall check Right of Way Agreements and see that same are complied with before job acceptance.
- Utilities, disturbed by new construction, shall be reset or replaced by the interested utility.
- Bench Markers will be furnished by the State and placed by the Contractor as per Standard C-38.
- Project Markers will be furnished by the State and placed by the Engineer as per Standard C-39.
- R/W Markers shall be furnished and placed by the Contractor as per Standard C-41.
- Changes in location or length of depressed curbs may be made by the Engineer in accordance with Standard D-5-5.

ROADWAY STANDARDS 1959

- C-1 Right of Way Markers
- C-2 Slopes
- C-7-1 Road Guard
- C-20 Concrete Curbs, Gutters & Sidewalks
- C-21 Curb & Gutter Measurements
- C-27-1 No. 3 Catch Basin
- C-33-1 Reinforced Concrete Pipe & Installation
- C-38 Project, Bench & Construction Markers
- C-43 Plans Symbols

INDEX OF SHEETS

Sheet	Title	Hoffman-Miller Drawing No.
1	Face Sheet	
2	Summary Sheet (This Sheet)	1
3	Plan & Profile	2
4	Plan & Profile	3
5	Location Plan	4
6	Abutment No. 1	5
7	Abutment No. 2	6
8	Sheet Pile Wall	7
9	Pier Details	8
10	Pier Details	9
11	Deck Details	10
12	Structural Steel Details	11
13	Structural Steel Details	12
14	Roadway Joint Standard RJ-2	
15	Handrail Standard H-1	

REDUCED SIZE
DO NOT SCALE

WICKENBURG - PHOENIX HIGHWAY
Maricopa County

Survey Δ
 $\Delta = 7^{\circ}04'40''$
 $D = 9'$
 $R = 636.62'$
 $T = 39.37'$
 $L = 78.64'$

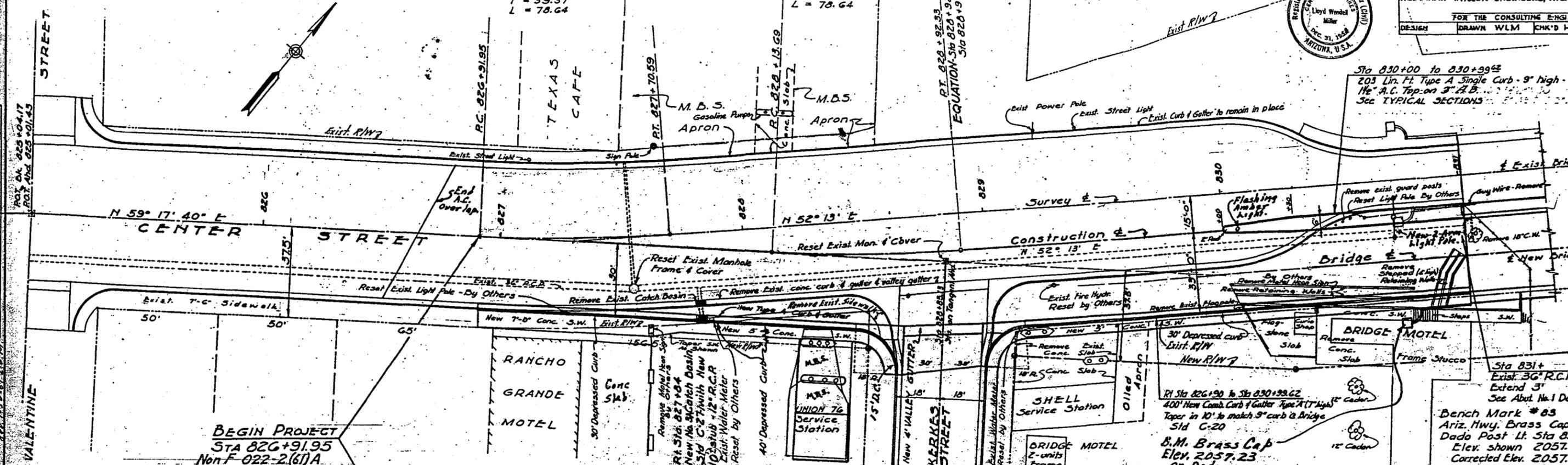
Constr. Δ
 $\Delta = 7^{\circ}04'40''$
 $D = 9'$
 $R = 636.62'$
 $T = 39.37'$
 $L = 78.64'$



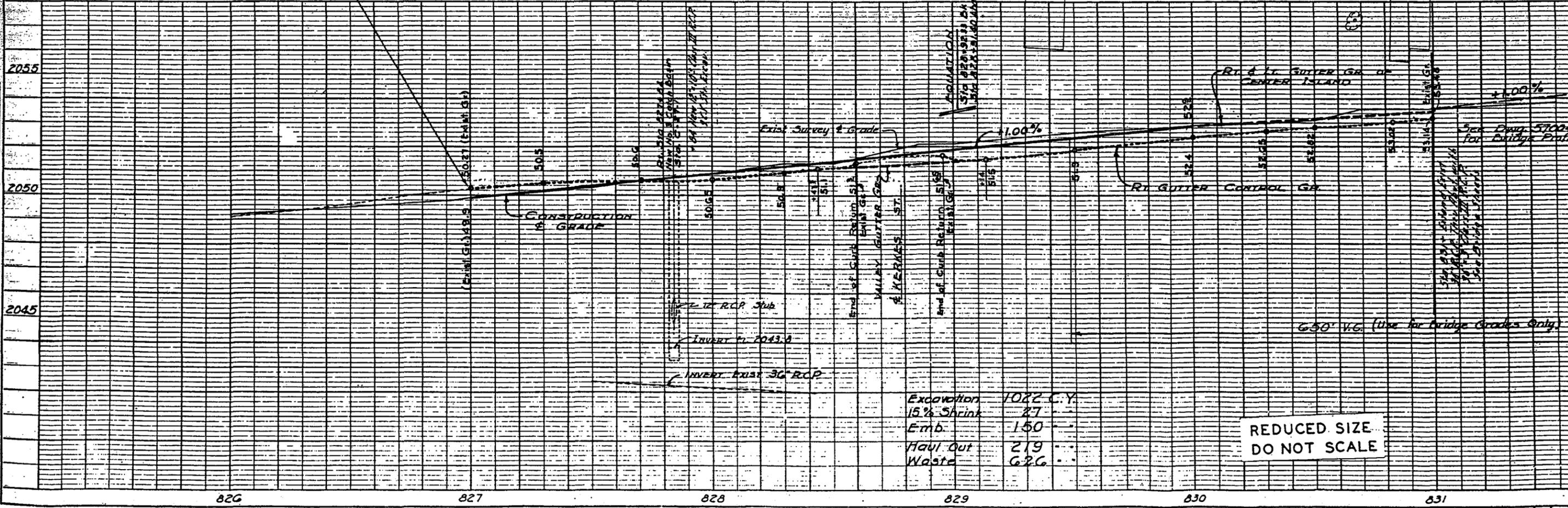
FED. ROAD DIV. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS B
7	ARIZ.	Non-F-022-2(6)A	3	15	5-21

HOF-F-MAN - MILLER ENGINEERS, INC.
 FOR THE CONSULTING ENGINEER
 DESIGN DRAWN WLM CHK'D H.E.

Sta 830+00 to 830+99.62
 203 Lin. Ft. Type A Single Curb - 9" high -
 No. 1 A.C. Top on 3" A.B.
 See TYPICAL SECTIONS



BEGIN PROJECT
 STA 826+91.95
 Non-F-022-2(6)A



Excavation	1022 C.Y.
15% Shrink	27
Emb	150
Haul Out	219
Waste	626

REDUCED SIZE
 DO NOT SCALE

650' V.G. (Use for Bridge Grades Only)

See Plan 57004 for Bridge Profile

WICKENBURG - PHOENIX HIGHWAY
Maricopa County

Fd. V4 Cor. U.S.G.L.O.
Brass Cap Set 1946

6" Nat. Gas Line
Ariz. Public Service Co

1" Water Line

4" Water Line

Bench Mark #83
Ariz. Hwy. Brass Cap on
Dado Post Lt Sta. 830+00
Elev. shown - 2057.92
Corrected Elev. - 2057.65

Sta 831+01.00 to Sta 835+81.80
6'-80" Spans Steel Girder Br. In Place
24' Clear Rdwy, 4' Sidewalk on Lt
To Remain in Place
Sta. 830+99.62 to Sta. 835+82.78
6'-80" Spans Steel Girder Br., New
30' Clear Rdwy, 5' Sidewalk Rt.

DM #83A - Ariz. Hwy. Dept. Brass Cap on Lt.
Dado, East end exist. Massayampa Bridge
Elev. shown 2057.09
Corrected Elev 2057.01

Sta 835+82.78 to 836+00
196 Lin. Ft Type A Single Curb
9" high. ~ 1/4" A.C. top on 3" A.B.
See TYPICAL SECTIONS

LI Sta 835+90
Remove 96 sq. ft. of conc sidewalk
76 sq. ft. of New Conc. Sidewalk 4"

B.M. Brass Cap on Dado
Elev. 2057.16

End Project
Sta 835+85
Non F 022 2 (1) A
Box F 022 2 (1)

New Constr. &
Δ = 121° 38' 00" Rt
D = 7' 17.56"
R = 785.51'
T = 1406.47'
L = 1666.46'
Super = 0.015'/ft.

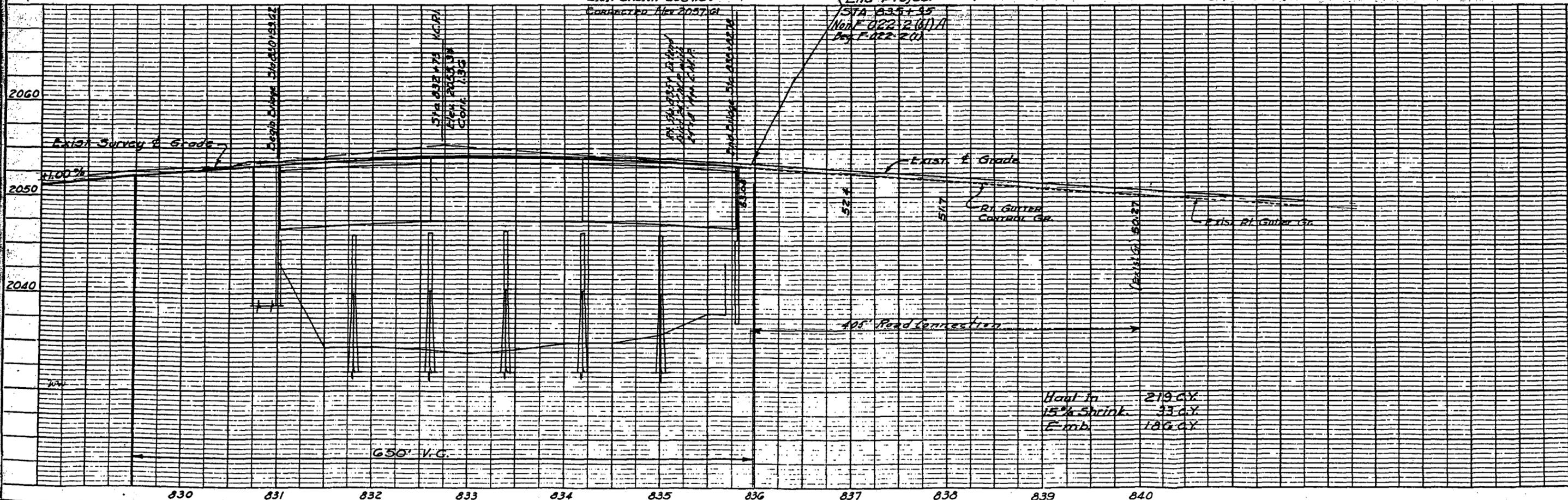
Survey &
Δ = 121° 38' 00" Rt
D = 7' 07.51"
R = 818.51'
T = 1465.55'
L = 1737.62'

Constr. & Ahead
Δ = 121° 38' 00" Rt
D = 7' 07.51"
R = 803.51'
T = 1438.69'
L = 1705.94'
Super = 0.015'/ft.

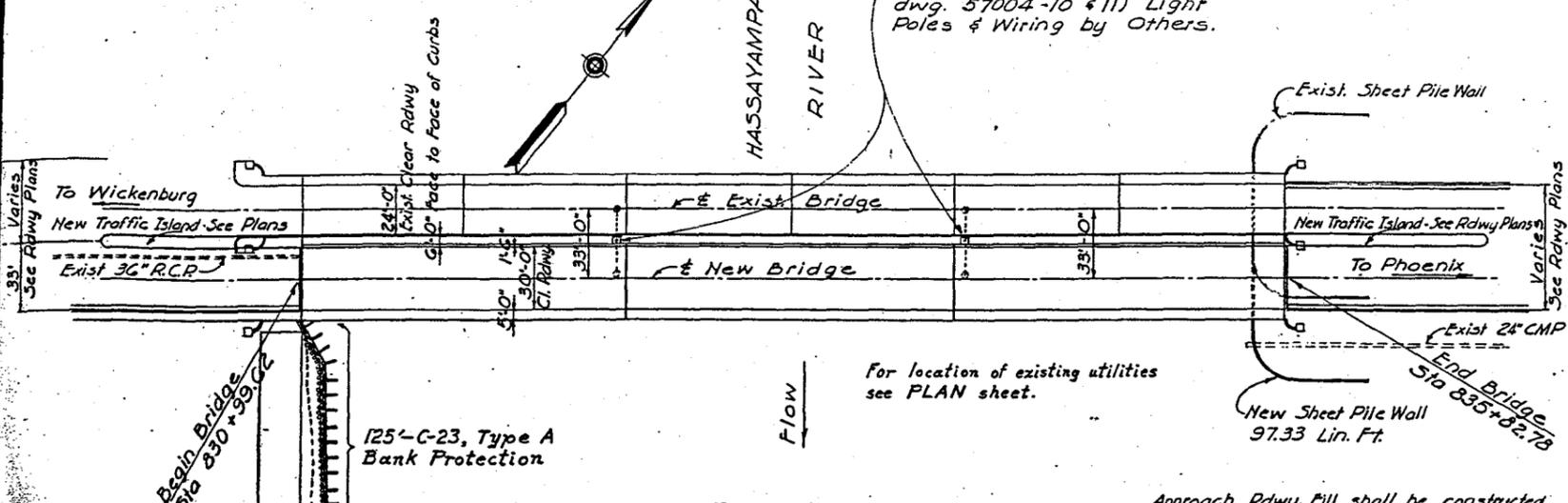
REDUCED SIZE
DO NOT SCALE

FED. ROAD DIV. NO.	STATE	PROJECT	SHEET NO.	TOTAL SHEETS	AS BUILT
7	ARIZ.	Non F022-2(1)A	4	15	Nov 76

HOFFMAN-MILLER ENGINEERS, INC.
FOR THE CONSULTING ENGINEER
DESIGN: DRAWN: WLM CHK'D: MB



WICKENBURG - PHOENIX HIGHWAY
Maricopa County



NOTE ~
The Contractor shall use care not to disturb the sand & gravel material around the existing footings of present bridge.

STA 833+
LOCATION PLAN
New G Span Steel Girder Bridge
Scale: 1" = 40'-0"

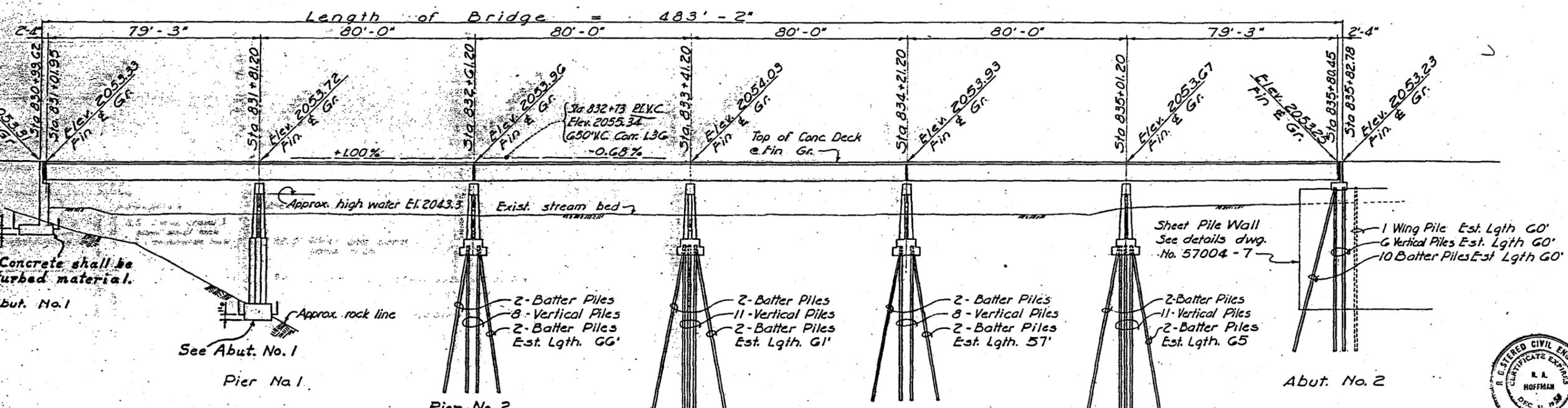
GENERAL NOTES

Construction - Standard Specifications Arizona Highway Department, Edition of 1960.
Design - AASHTO. Specs. of 1957, revised to date.
Loading Class - H 20 - S16 - 1944
Stresses: Structural steel $f_s = 18,000 \text{ #/in}^2$
Class A Conc: $f_c = 20,000 \text{ #/in}^2$ $f_t = 1000 \text{ #/in}^2$ $n=12$
Class D Conc: $f_c = 20,000 \text{ #/in}^2$ $f_t = 1200 \text{ #/in}^2$ $n=10$
No wearing surface allowance in deck slab design.
Reinforcing steel: A.S.T.M. A-15 Intermediate grade and A.S.T.M. A-305 High bond.
Structural steel (including H piling and sheet piling) - A.S.T.M. A-7
Welding shall conform to American Welding Society Specs. for welded Hwy. & Railway Bridges.
Paint and painting shall conform to Std. Specs.
Shop paint: One coat paint No. 1A or 1B
Field paint: First coat paint -- No. 3
Second coat paint -- No. 10
Contact surfaces shall not be painted.
Payment for the structural steel item shall be made on the basis of computed weights in accordance with Standard Specs., Edition of 1960.
All pile cutoff shall be hauled to Durango Yard, Phoenix, for storage.
Tremie Concrete: Class A Concrete plus 10% added Cement.

Proj. No.	7	State	ARIZONA	Project No.	Non F-022-2(61)A	Sheet No.	5	Total Sheets	62	Scale	1" = 40'-0"
-----------	---	-------	---------	-------------	------------------	-----------	---	--------------	----	-------	-------------

Steel sheet piles shall be on arch web section as per manufacturer's standard - See details, dwg
Used sheet piling may be furnished subject to approval on the following conditions:
1. Piles shall be free from thick, loose, scaly rust.
2. Piles shall be in a satisfactory condition for re-driving; straight, free of battered or torn ends and with interlocks true and unbroken.
3. Weight of piles shall be at least 95% of original section.
Sheet pile wall shall be painted from 2' below low stream bed to top of wall, both faces:
Inside Face - 2 coats #50 Koppers Bitumastic or approved equal.
Outside Face - Same as structural steel. (Paint exist. sheet pile wall)

REDUCED SIZE
DO NOT SCALE



Neat line excavation. Concrete shall be placed against undisturbed material.

SECTION on ROADWAY
Scale: 1" = 20'-0"



PILE NOTE -

All abut. & pier brg. piles shall be 12" BP 53# - Est. Lgths as shown.
Minimum penetration all pier piles to Elev. 1975.0 with minimum bearing 43 Tons.
Minimum penetration all abutment brg. piles to Elev. 1990.0 with minimum bearing 21 Tons.



HOFFMAN-MILLER ENGINEERS

DESIGN	LWM	7-57
DRAWN	WLM	8-57
CHK'D	MEK	10-57

APPROXIMATE QUANTITIES

ITEM	Std. No.	Sheet No.	Struc. Exc. C.Y.	Class A Conc. C.Y.	Class D Conc. C.Y.	Reinf. Steel Lbs.	Struc. Steel Lbs.	Remove Ex. Conc. C.Y.	Sheet Pile Lin. Ft.	Drill & Set Down. Ea	Steel Hdr'l Lin. Ft.	Steel H-Piling Lin. Ft.	Spec. Comp. C.Y.		
Abutment No. 1	6	710	23097	-	-	13,755	-	3	-	7	-	-	680		
Pier No. 1	9	170	18613	30	-	14,545	-	-	-	-	-	-	-		
No. 2	9	170	6440	30	-	8,680	-	-	-	-	-	12	792		
No. 3	9	170	6440	30	-	8,680	-	-	-	-	-	15	915		
No. 4	9	170	6440	30	-	8,680	-	-	-	-	-	12	684		
No. 5	9	170	6440	30	-	8,680	-	-	-	-	-	15	975		
Abutment No. 2	7	8	30	5447	-	4,500	-	3	2565	-	-	17	1020		
Deck & Hdr'l.	11-7	11-13	-	-	-	40461	77565	45448	-	-	961	-	-		
BRIDGE TOTALS			20007	29171	120.00	40461	145085	45448	6	2565	7	961	71	4386	740

Std. Rdwy. Jt. RJ-2 Sheet No. 10 of 11 125 lin. ft. Bank Protection
Std. Hdr'l H-1 Sheet No. 11 of 11 Type A C-23
Note: Payment for 3" & hdr'l. post anchor bars shall be included in unit price bid for handrail.

NOTE - See construction special provisions - This is a contingent item - if seal is not required, item will be deleted.

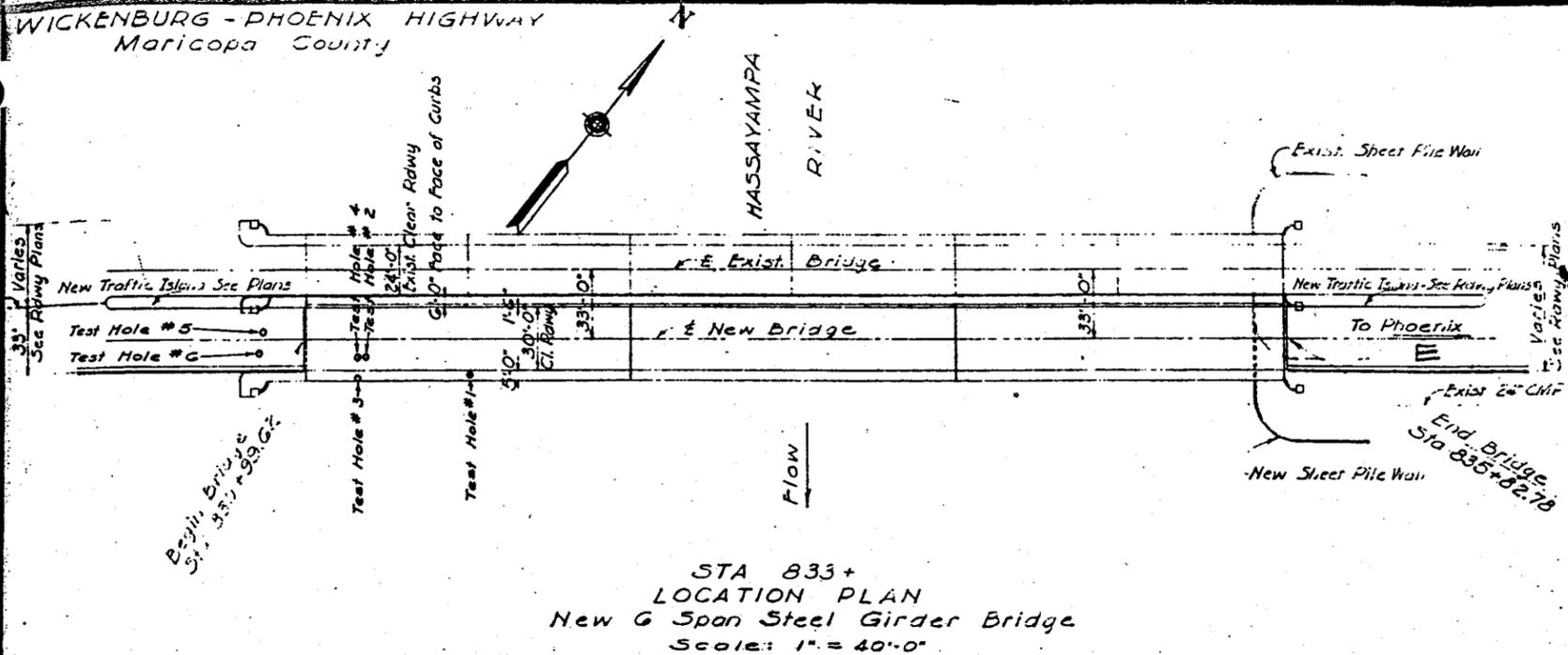
110.53

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

STA 833+
HASSAYAMPA RIVER BRIDGE
LOCATION PLAN

BRIDGE NUMBER 737
DRAWING NUMBER 57004-4

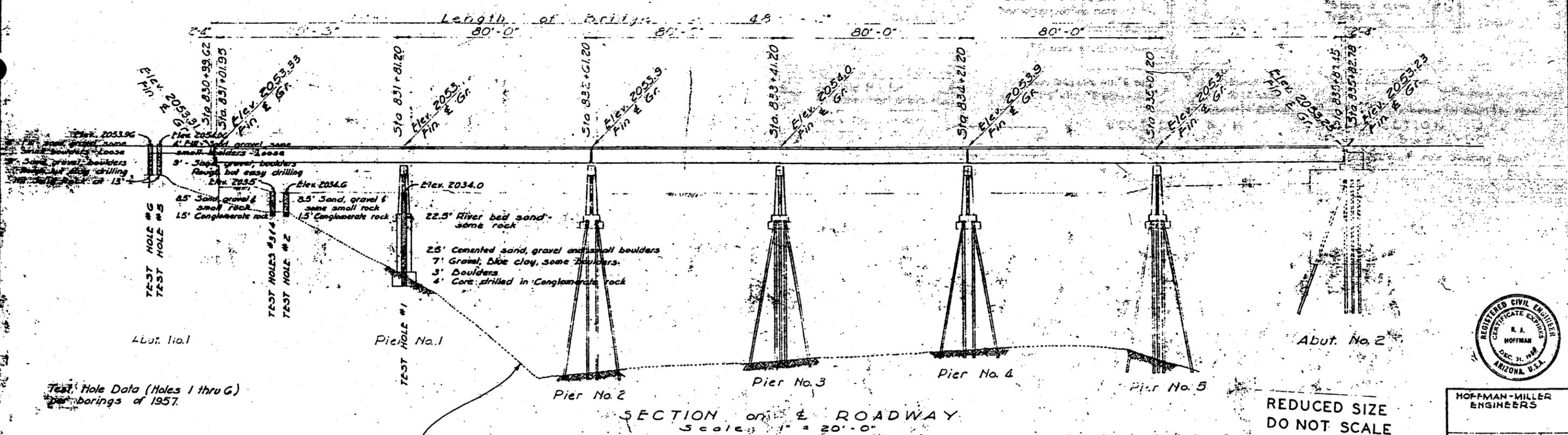
WICKENBURG - PHOENIX HIGHWAY
Maricopa County



GENERAL NOTES
Construction Standards Specifications Arizona
Highway Department, Edition of 1960.
Design - AASHTO Specs. of 1957, revised to date.
Loading Class - H 20 - S16 - 1944
Stresses: Structural steel $f_s = 18,000 \text{ psi}$
Class A Concr: $f_c = 20,000 \text{ psi}$ $f_t = 1,000 \text{ psi}$ $n=12$
Class D Concr: $f_c = 20,000 \text{ psi}$ $f_t = 1,200 \text{ psi}$ $n=10$
No wearing surface allowance in deck slab design.
Reinforcing steel: A.S.T.M. A-15 Intermediate grade
and A.S.T.M. A-305 High bond.
Structural steel (including H piling and
sheet piling) - A.S.T.M. A-7
Welding shall conform to American Welding Society
Specs. for welded Hwy. & Railway Bridges.
Paint and painting shall conform to Std. Specs.
Shop paint: One coat paint No. 1A or 1B
Field paint: First coat paint -- No. 3
Second coat paint -- No. 10
Contact surfaces shall not be painted.
Payment for the structural steel items shall be
made on the basis of computed weights
in accordance with Standard Specs.

PROJ. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	DATE
7	ARIZONA	Non F-022-2(6)A	5A	5	5-28-62

Steel sheet piles shall be in arch web
section as per manufacturer's
standard - See details and
Used sheet piling may be furnished subject
to approval on the following conditions:
1. Piles shall be free from thick, loose,
scaly rust.
2. Piles shall be in a satisfactory condi-
tion for redriving; straight, free of
battered or torn ends and with inter-
locks true and unbroken.
3. Weight of piles shall be at least
95% of original section.
Sheet pile wall shall be painted from 2' below
low stream bed to top of wall, both
faces, with 2 field coats of Koppers -
Dipomastic or approved equal.
1st coat: Koppers #50, both faces.
2nd coat: Koppers #50 inside face
#28, outside face.



HOFFMAN-MILLER
ENGINEERS

DESIGN		
DRAWN	WLM	8-57
CHK'D	PEK	10-57

THIS IS NOT A CONTRACT DRAWING
FOR INFORMATIONAL PURPOSES ONLY

REDUCED SIZE
DO NOT SCALE

ARIZONA HIGHWAY DEPARTMENT BRIDGE DIVISION	
STA 833+ HASSAYAMPA RIVER BRIDGE	
DATE	5-28-62
DESIGNED	
DRAWN	
CHECKED	



A.10 US 93 (Tegner Street) Bridge Over Sols Wash As-Built Drawings

F.L.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	035-1(56)P	10	30	

93 MA 199

CURVE DATA
 PI Sta 807+41.24
 Main Curve
 $\Delta = 22^\circ 35' 56''$ Lt
 $D = 03^\circ 00' 00''$
 $T = 381.60'$
 $R = 1909.86'$
 $L = 753.30'$

Refer to Pavement Preservation Project 093MAH468601C. For AR-ACFC Paving Limits

STA 798+85.36
BEGIN PROJECT

STA 806+09.42
END PROJECT

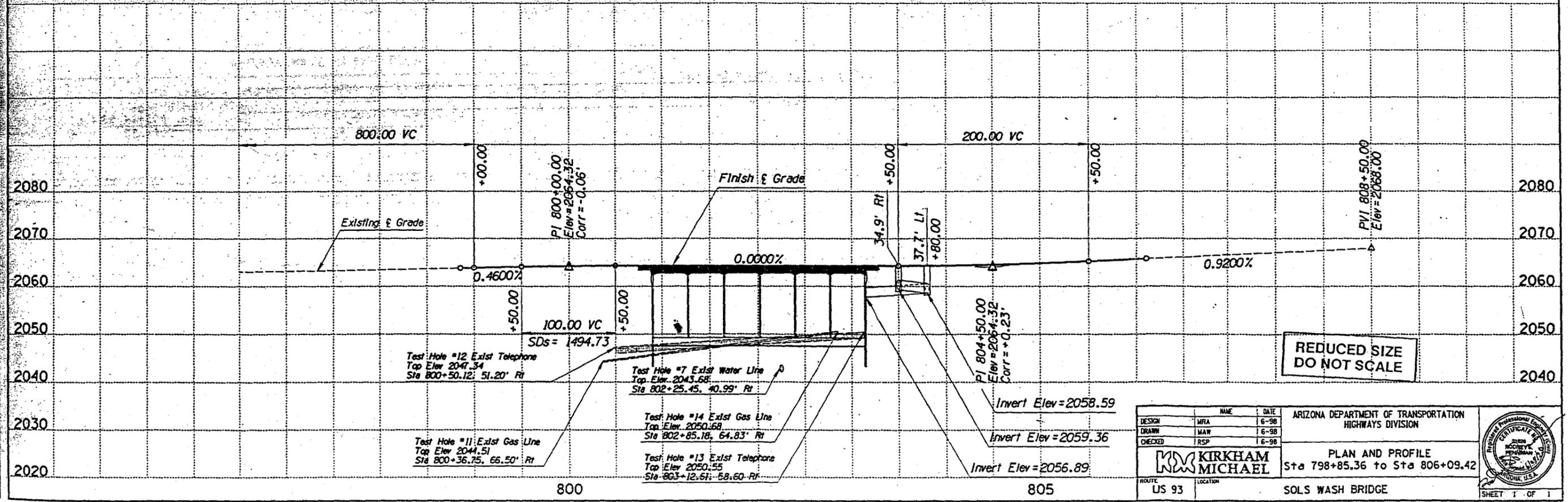
Refer to Pavement Preservation Project 093MAH468601C. For AR-ACFC Paving Limits

Survey & Construction ϵ

Match Existing Conc Sdwk
Match Exst Curb & Gutter

Sta 800+89.21 to 803+14.98
New Bridge
See Structure Sheets

Match Existing Conc Sdwk
Match Exst Curb & Gutter



REDUCED SIZE
DO NOT SCALE

DESIGN	MRA	DATE	6-98
DRAWN	MAW	DATE	6-98
CHECKED	RSP	DATE	6-98

KIRKHAM MICHAEL

ROUTE: US 93 LOCATION: SOLS WASH BRIDGE

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLAN AND PROFILE
Sta 798+85.36 to Sta 806+09.42

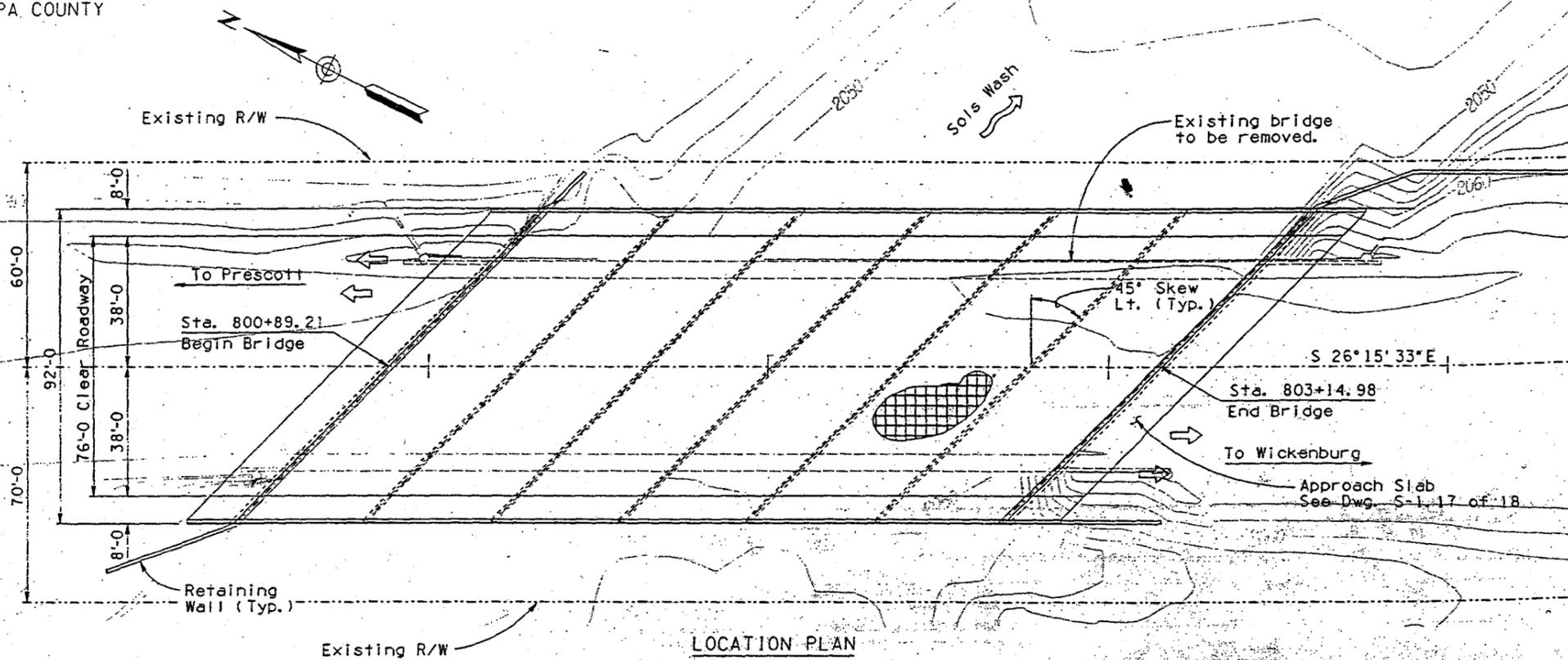
SHEET 1 OF 1

\$FILES\$
\$DATE\$ \$TIME\$

WICKENBURG - KINGMAN HWY. (US 93)
SOLS WASH BRIDGE
MARICOPA COUNTY

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	-035-1(56)P	11	30	

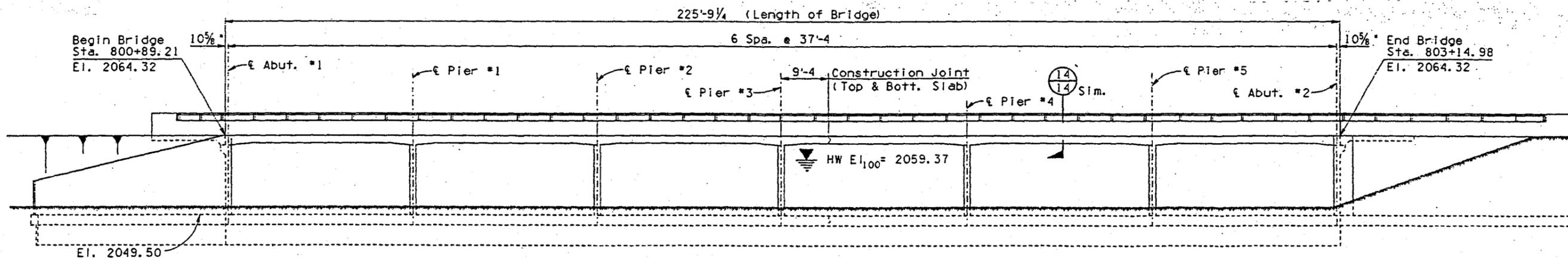
93 MA 199



LOCATION PLAN
New 6 Span R.C. Box Culvert Bridge
Skew 45° Rt.
Scale: 1"=20'-0"

SHEET LIST

TITLE	NO.
General Plan	1
General Notes & Quantities	2
Construction Phasing Details	3
Foundation Layout	4
Foundation Details	5
Abutment Details - 1	6
Abutment Details - 2	7
Abutment Details - 3	8
Wingwall Details	9, 10, 11
Pier Details	12
Deck Details	13
Retaining Wall Details	14
Miscellaneous Details	15
Excavation and Backfill Details	16



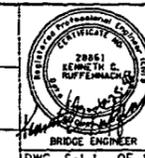
ELEVATION
Sta.'s & Elev.'s on US 93
Scale: 1"=10'-0"

HYDRAULIC DATA

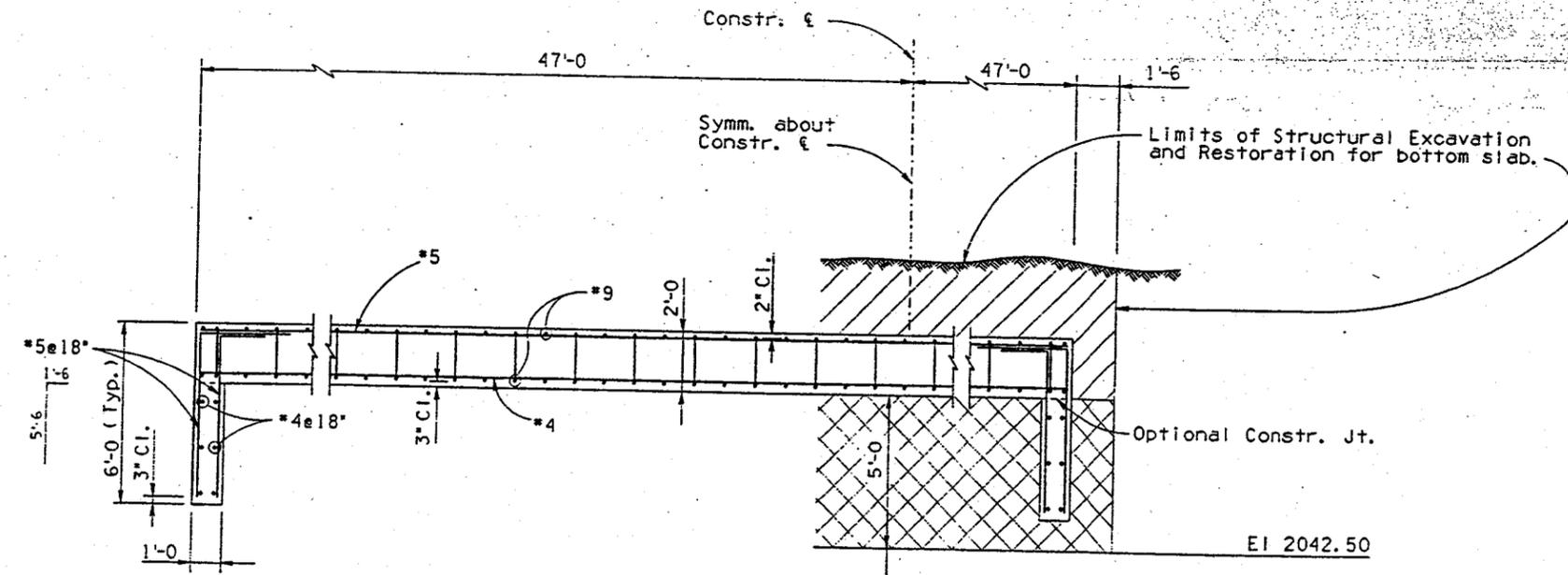
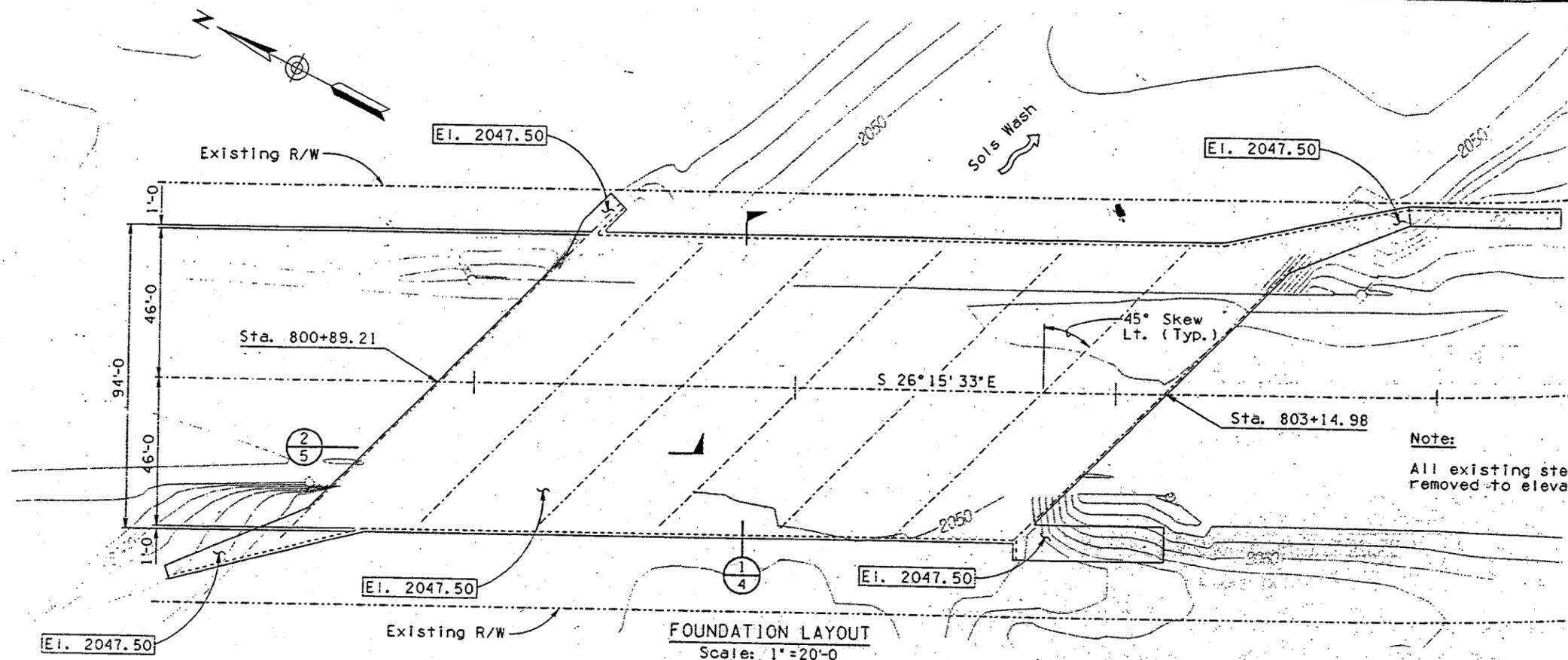
Q₅₀ = 12,453 cfs
Q₅₀₀ = 20,836 cfs

REDUCED SIZE
DO NOT SCALE

BRIDGE DESIGN SECTION		DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION BRIDGE GROUP	
DESIGN	C. Hubbard	11-97	STA. 800+ SOLS WASH BRIDGE GENERAL PLAN LOCATION SOLS WASH BRIDGE DWG. S-1.1 OF 16	
DESIGN CKD	K. Ruffenach	11-97		
DRAWN	J. Kessler	11-97		
DWG CKD	K. Ruffenach	11-97		
APPROVED-PROJ. ENGINEER	K. Ruffenach	6-98	US 93 199.56 2688 ROUTE MILEPOST STRUCTURE NO.	
APPROVED-DESIGN LEADER	S. Hasen	6-98		



F.L.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	-035-1(56)P	14	32	
93 MA 199					



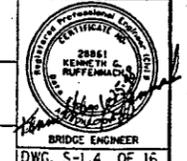
le = 2049.50

**REDUCED SIZE
DO NOT SCALE**

NOTE: Scale: 3/8" = 1'-0" (1)
 Allowable Bearing Pressure = 1.2 ksf
 Modulus of Subgrade Reaction = 350 pci/in.
 [Symbol] Denotes Bottom of Footing Elevations

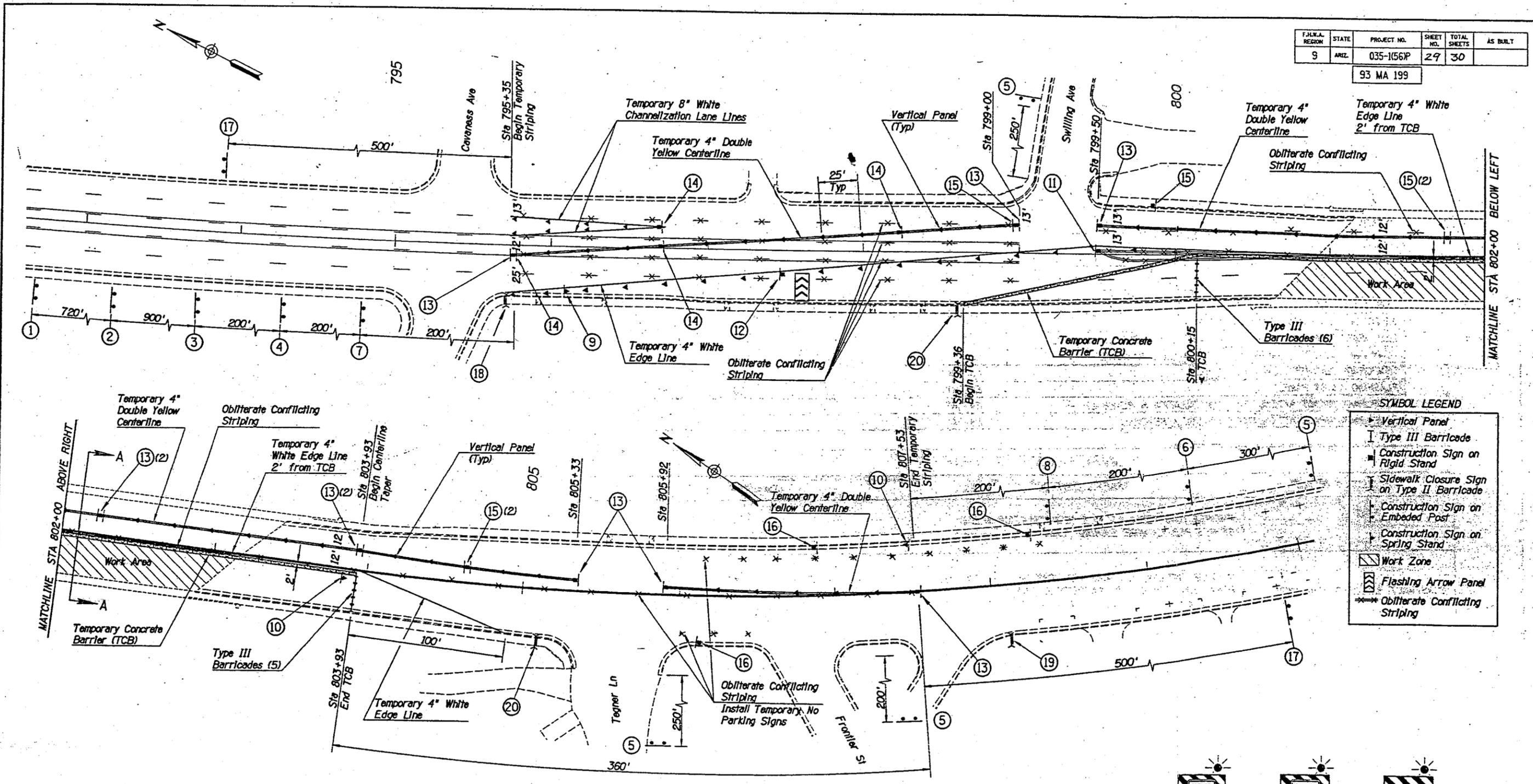
CONSTRUCTION JOINT NOTE:
 At Contractor's option, transverse construction joints may be provided at 6'-0 from & Pier.

BRIDGE DESIGN SECTION #'	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION BRIDGE GROUP						
DESIGN	C. Hubbard 11-97							
DESIGN CRT	K. Ruffenach 11-97							
DRAWN	J. Kessler 11-97							
CHKD	K. Ruffenach 11-97							
APPROVED-PROJ. ENGINEER	K. Ruffenach 16-98	STA. 800+ SOLS WASH BRIDGE FOUNDATION LAYOUT						
APPROVED-DESIGN LEADER	S. Hasen 6-98							
ROUTE	199.56	2688	LOCATION	SOLS WASH BRIDGE				
<table border="1"> <tr> <td>US 93</td> <td>199.56</td> <td>2688</td> <td>LOCATION</td> <td>SOLS WASH BRIDGE</td> </tr> </table>				US 93	199.56	2688	LOCATION	SOLS WASH BRIDGE
US 93	199.56	2688	LOCATION	SOLS WASH BRIDGE				



F.J.W.L.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	035-1156P	29	30	

93 MA 199

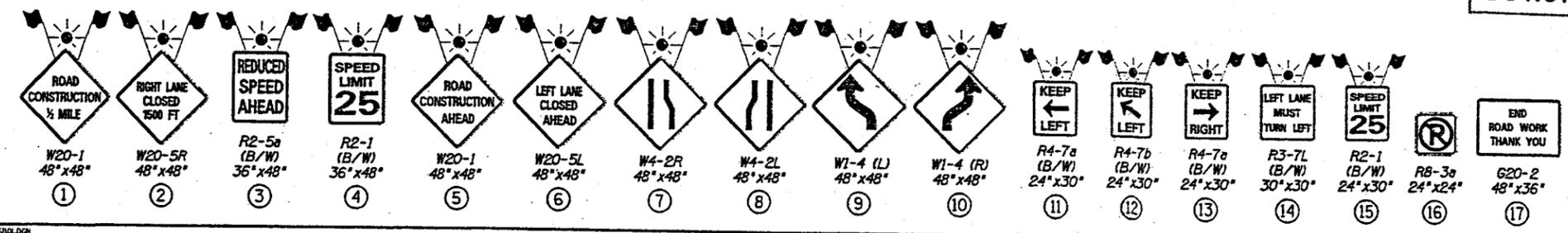


SYMBOL LEGEND

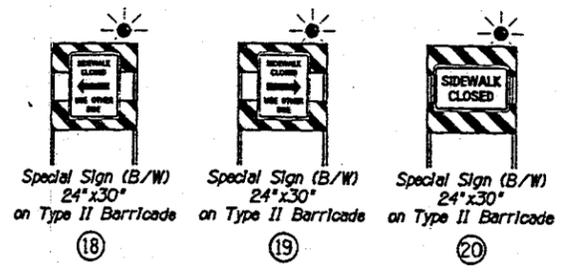
- Vertical Panel
- Type III Barricade
- Construction Sign on Rigid Stand
- Sidewalk Closure Sign on Type II Barricade
- Construction Sign on Embedded Post
- Construction Sign on Spring Stand
- Work Zone
- Flashing Arrow Panel
- Obliterate Conflicting Striping

SIGN LEGEND

"B/W" signifies Black letters on a White background



REDUCED SIZE
DO NOT SCALE



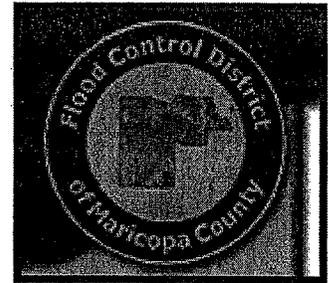
DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION
DRAWN	JAC	6/98	
CHECKED	IDB	6/98	
CK Engineering, Inc. Traffic & Transportation Engineers 450 E. Greenway Rd. Suite 4 Phoenix, AZ 85021 Phone: 602-832-8800 Fax: 602-832-8801			TRAFFIC CONTROL MAINTENANCE OF TRAFFIC SOUTHBOUND LANE CLOSURES
ROUTE	LOCATION		
SR 93	SOLS WASH BRIDGE		



A.11 Project Correspondence



3747 East Grove
Street
Phoenix, AZ 85040
602.454.0402
602.454.0403



Meeting Agenda

Meeting Date: May 17, 2005

Meeting Time: 2:00 pm

Location: FCDMC 2801 W. Durango Street Phoenix, Arizona

Subject: Hassayampa River Post - Flood Study in the Town of Wickenburg
Progress Meeting Number 1 AGENDA

I. Introductions

II. Meeting Goals

- Schedule
- Present Progress Report
- Develop the Table of Contents for the Report
- Set the date and discuss timeline for the Stakeholder Meeting
- Draft Invoice

III. Data Collected

- FCD Mapping
- FCD Library Information
- Video – Post-Flood, during Flood?
- US 93 As-Builts
- Recent Supplemental Information
- Historic Aerial Photographs and Mapping
- Hydraulic Models – West Consultants

IV. Follow Up/Action Items

- Approval for data collection to West by FCD
- Request for Video Footage to Fox News by FCD
- Next Progress Meeting

V. Adjourn



4561 E. McDowell Road
Phoenix, Arizona 85008
(602) 454-0402
(602) 454-0403 Fax

Meeting Minutes

Meeting Date:	05-17-05	Meeting Time:	2:00
Location:	FCDMC	Project:	Hassayampa River Post-Flood Report
Subject:	First Progress Meeting	Project No:	2002C030
Attendees:	Debbie Shortall, FCDMC Tony Bokich, AZTEC Patrick Wolf, AZTEC	Aztec No.	AZ03152
Prepared By:	Patrick Wolf	Date Published:	05-23-03

This meeting was held to discuss the progress of the Hassayampa River Post-Flood Study. There were four major topics for discussion in this meeting: Schedule, Data Collection, Draft Table of Contents for the Final Report, and planning the Stakeholder Meeting. Greg Jones had a conflicting meeting and was not able to attend this meeting.

Project Schedule

This project is on a very condensed schedule. The Draft Report is due the week of May 30 and the Final Report is due the week of June 13th. Aztec will schedule a review meeting with the Flood Control District (FCD) one week after the draft report and final report submittals to expedite the progress.

Draft Table of Contents

Aztec prepared a draft table of contents (TOC) based on the Scope of Work. The draft TOC was submitted to Debbie for FCD review. FCD will review and send comments to Aztec by Friday May 27. If no comments are received by that date, then Aztec assumes the Table of Contents is acceptable to the FCD.

Data Collection

Approximately 75% of the data collection has been accomplished. Some outstanding materials still being pursued are the hydraulic models created for the US 93 bypass by West Consultants and the historic photography and mapping information. Debbie said she would collect the historic aerials from FCD and get them to Aztec as soon as possible. West Consultants will release the data to Aztec once they receive permission from ADOT. Aztec has requested the video from Fox 10 News, however they only gave permission to use the video for personal use. FCD will pursue permission to use the information for this study.

Stakeholder Meeting

A stakeholder meeting will be held as part of this project. The date of this meeting, discussion topics, and invitees will be determined by FCD by May 27.

Action Items

Draft Table of Contents review comments by May 27 - Flood Control
Historic Aerial Photographs - Flood Control
Stakeholder Meeting Date by May 27 - Flood Control
Contact Information for Fox 10 News - Aztec
Request for Video from Fox 10 News - Flood Control
Invoice - Aztec
Meeting Minutes - Aztec

Copies:

Greg Jones
Debbie Shortall
Tony Bokich
File



May 13, 2005

Ms. Victoria Wheeler
Aztec Engineering
4651 East McDowell Rd.
Phoenix, AZ 85005

Via Fax

Re: Non-Commercial/Educational License with Fox Television Stations, Inc.

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Very truly yours,

FOX TELEVISION STATIONS, INC.

BY: _____

TITLE: _____

ACCEPTED AND AGREED TO:

BY: _____

DATE: _____

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Monday, April 25, 2005 11:44 AM
To: Patrick A. Wolf
Subject: RE: Hasayampa Field Trip

Patrick,

First, we are meeting at Starbucks at the North West Corner of Bell and Grand at 9:00.

Second, NRCS will be with us to visit the Hourspatality RV Site.

Third, you may visit with Mr. Jons. I can not due to Legal Reasons. Just collect data per the Scope of work.

Sincerely,

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Monday, April 25, 2005 11:21 AM
To: Greg Jones - FCDX
Subject: Hasayampa Field Trip

Greg-

Did you want to meet with Ray Johns during Thursday's field trip? (His home was the one washed away.) The manager of the Hospitality trailer park said that he has a lot of pictures and information. We are meeting at the McDonalds on Grand Ave, just north of Bell Road at 9:00 AM, correct? Who will be joining us? I need to reserve a vehicle large enough for everyone.

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Tuesday, April 26, 2005 11:26 AM
To: Patrick A. Wolf
Cc: Mona Merkevicus - FCDX
Subject: RE: Hasayampa PCN

Patrick,

Until I have a signed work assignment I can not proceed. I know that I gave this to Tim Yesterday. So the work assignment should be approved in short order. At that time I will contact Mona and have her release the copies.

Please note, you are not suppose to perform work under the work assignment until you have a signed copy.

Sincerely,

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, April 26, 2005 9:51 AM
To: Greg Jones - FCDX
Subject: Hasayampa PCN

Greg-

Can you send me the new PCN for this project? We have a lot of information ready to be copied at the Flood Control Library, but Mona needs to charge the copies to a PCN.

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Greg Jones - FCDX [gj@mail.maricopa.gov]
Sent: Tuesday, April 26, 2005 6:11 PM
To: Patrick A. Wolf
Cc: Mona Merkevicus - FCDX
Subject: RE: Hasayampa PCN

Patrick,

Good news I have the signed work assignment. It is at the front desk.
The PCN number is 346.01.20.

Sincerely,

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, April 26, 2005 9:51 AM
To: Greg Jones - FCDX
Subject: Hasayampa PCN

Greg-

Can you send me the new PCN for this project?
We have a lot of information ready to be copied
at the Flood Control Library, but Mona needs to
charge the copies to a PCN.

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Victoria Wheeler
Sent: Friday, April 29, 2005 11:56 AM
To: Patrick A. Wolf
Subject: RE: Hassayampa News Coverage

Called both stations already. Fox News (channel 10) actually has a department that handles all video requests. I left a message for the lady in charge and expect to hear from her. NBC local news (channel 12) cannot help us. Their policy does not allow them to give out any video. Talked to the operations manager.

Victoria

-----Original Message-----

From: Patrick A. Wolf
Sent: Friday, April 29, 2005 10:52 AM
To: Victoria Wheeler
Subject: Hassayampa News Coverage

Victoria-

Can you also research getting the news reports from Fox News and NBC news? The flood occurred on Feb. 12 and both these local news stations had helicopters video taping the damages as they happened. We would like the info on a CD.

Thanks, PW

Patrick A. Wolf

From: Eric Feldman - FCDX [emf@mail.maricopa.gov]
Sent: Thursday, May 12, 2005 4:29 PM
To: Patrick A. Wolf
Subject: RE: Wickenburg Mapping & Aerials

Could you recheck the DTM tile #s? There is no 4651065. I think you mean 4651075.

Eric Feldman
GIS Analyst

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Wednesday, May 11, 2005 9:41 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study; Tony Bokich
Subject: Wickenburg Mapping & Aerials

Eric-

We are working on a on-call contract for the Flood Control for the flooding that happened Feb. 16, 2005, in Wickenburg. We need to collect the topography and aerial maps for this area. There should be at least 2 different flight dates for the topography, I am not sure how many flights for the aerials. We need all the data to determine how the river changed over the years. The contract number is FCD 2002C030 and the PCN number is 346.01.20.

The topography panels are: 4501090, 4501075, 4651065, 4651060.

The aerial panels are: 4501090, 4551090, 4501085, 4551085, 4501080, 4601080, 4551075, 4601075, 4601070, and 4651070

Thank you,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Friday, May 13, 2005 9:51 AM
To: Patrick A. Wolf; Eric Feldman - FCDX
Cc: AZ03152 Hasayampa Flooding Study; Tony Bokich
Subject: RE: Wickenburg Mapping & Aerials

Eric,

Please charge your time to 346.01.20.

Sincerely,

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Wednesday, May 11, 2005 9:41 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study; Tony Bokich
Subject: Wickenburg Mapping & Aerials

Eric-

We are working on a on-call contract for the Flood Control for the flooding that happened Feb. 16, 2005, in Wickenburg. We need to collect the topography and aerial maps for this area. There should be at least 2 different flight dates for the topography, I am not sure how many flights for the aerials. We need all the data to determine how the river changed over the years. The contract number is FCD 2002C030 and the PCN number is 346.01.20.

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The aerial panels are: 4501090, 4551090, 4501085, 4551085, 4501080, 4601080, 4551075, 4601075, 4601070, and 4651070

Thank you,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Eric Feldman - FCDX [emf@mail.maricopa.gov]
Sent: Friday, May 13, 2005 1:40 PM
To: Greg Jones - FCDX; Patrick A. Wolf
Cc: AZ03152 Hasayampa Flooding Study; Tony Bokich
Subject: RE: Wickenburg Mapping & Aerials

The data you requested is ready at the front desk of the Flood Control District of Maricopa County.

Eric Feldman
GIS Analyst

-----Original Message-----

From: Greg Jones - FCDX
Sent: Friday, May 13, 2005 9:51 AM
To: 'Patrick A. Wolf'; Eric Feldman - FCDX
Cc: AZ03152 Hasayampa Flooding Study; Tony Bokich
Subject: RE: Wickenburg Mapping & Aerials

Eric,

Please charge your time to 346.01.20.

Sincerely,

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Wednesday, May 11, 2005 9:41 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study; Tony Bokich
Subject: Wickenburg Mapping & Aerials

Eric-

We are working on a on-call contract for the Flood Control for the flooding that happened Feb. 16, 2005, in Wickenburg. We need to collect the topography and aerial maps for this area. There should be at least 2 different flight dates for the topography, I am not sure how many flights for the aerials. We need all the data to determine how the river changed over the years. The contract number is FCD 2002C030 and the PCN number is 346.01.20.

The topography panels are: 4501090, 4501075, 4651065, 4651060

The aerial panels are: 4501090, 4551090, 4501085, 4551085, 4501080, 4601080, 4551075, 4601075, 4601070, and 4651070

Thank you,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Leo Kreymborg [leok@westconsultants.com]
Sent: Wednesday, May 18, 2005 2:15 PM
To: Patrick A. Wolf
Subject: Re: US 93 Bypass

Patrick,

I'm waiting for ADOT's OK to send you this information.

Regards,
Leo.

Patrick A. Wolf wrote:

>Leo-

>

>As discussed in our phone conversation yesterday, Aztec is working with Flood
>Control on documenting the recent flooding in Wickenburg, AZ. We understand
>that West Consultants created an existing and proposed condition hydraulic model
>for the US 93 bypass through Wickenburg. Would it be possible to obtain a copy
>of the digital hydraulic models along with any pertinent data (figures, text, etc..)?

>

>Did West Consultants do any supplemental survey along the river? Did you create
>an updated topographic map or perform any geomorphic analysis? Do you
>have the as-built plans for the existing US 93 bridge?

>

>The Project Manager at Flood Control is Greg Jones. Do you need to get approval from
>the ADOT Project Manager for this data request? Is the ADOT PM Larry Doescher?

>

>Thank you,

>

>Patrick Wolf, P.E.
>Aztec Engineering
>(602) 458-9269
>(602) 458-9359 - fax

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Leo Ramos Kreymborg, P.E.
WEST Consultants, Inc.
960 West Elliot Road
Suite 201
Tempe, Arizona 85284
(480) 345-2155
(480) 345-2156 Fax
<http://www.westconsultants.com>

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Monday, May 23, 2005 3:15 PM
To: Steve Waters - FCDX
Cc: Tony Bokich; AZ03152 Hasayampa Flooding Study; Patrick A. Wolf
Subject: RE: Wickenburg Flooding Feb.16

Steve,

Can you send or direct him to any reports that you have done on this subject.

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Monday, May 23, 2005 3:13 PM
To: Steve Waters - FCDX
Cc: Greg Jones - FCDX; Tony Bokich; AZ03152 Hasayampa Flooding Study
Subject: Wickenburg Flooding Feb.16

Steve-

Aztec is working with Flood Control on a Post-Flood Study for Wickenburg for the flooding that happened on Feb. 16, 2005. Greg Jones said that you had some good data regarding this flooding. Could you please send me that information?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Eric Feldman - FCDX [emf@mail.maricopa.gov]
Sent: Tuesday, May 24, 2005 11:11 AM
To: Patrick A. Wolf
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

There is no attachment for this email, please re-send.

Eric Feldman
GIS Analyst

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, May 24, 2005 11:10 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study
Subject: Wickenburg / Hassayampa Historic Topo & Aerial Info

Eric-

Here is the border for the mapping info I need for the Hassayampa Post-Flood Study. You already sent Aztec the 2005 aerials and the 2001 Topo Files. I need the older aerial and topographic mapping for whatever years you have. I also need the latest topo information, Greg Jones said there was topo generated in late 2004?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Steve Waters - FCDX [sdw@mail.maricopa.gov]
Sent: Tuesday, May 24, 2005 11:17 AM
to: Patrick A. Wolf
Cc: Greg Jones - FCDX
Subject: RE: Wickenburg Flooding Feb.16

Hi,

The bulk of the Wickenburg information is included in this report located on our web site:

http://156.42.96.39/alert/WY05/StormRpt_Feb2005.pdf

Let me know if you need more detailed information.

Stephen D. Waters
Flood Warning Branch Manager
Flood Control District of Maricopa County
602-506-4694
sdw@mail.maricopa.gov
www.fcd.maricopa.gov

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Monday, May 23, 2005 3:13 PM
To: Steve Waters - FCDX
Cc: Greg Jones - FCDX; Tony Bokich; AZ03152 Hasayampa Flooding Study
Subject: Wickenburg Flooding Feb.16

Steve-

Aztec is working with Flood Control on a Post-Flood Study for Wickenburg for the flooding that happened on Feb. 16, 2005. Greg Jones said that you had some good data regarding this flooding. Could you please send me that information?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Leo Kreymborg [leok@westconsultants.com]
Sent: Monday, May 23, 2005 5:32 PM
To: Patrick A. Wolf
Subject: Re: US 93 Bypass

Patrick,

I just got ADOTs OK today to forward this information. I'm teaching a short course in Phoenix today through Wednesday, but I'll come in Tuesday morning to the office and see if I can put together some files for you.

Regards,
Leo.

Patrick A. Wolf wrote:

>Leo-

>

>As discussed in our phone conversation yesterday, Aztec is working with Flood Control on documenting the recent flooding in Wickenburg, AZ. We understand that West Consultants created an existing and proposed condition hydraulic model for the US 93 bypass through Wickenburg. Would it be possible to obtain a copy of the digital hydraulic models along with any pertinent data (figures, text, etc..)?

>

>Did West Consultants do any supplemental survey along the river? Did you create an updated topographic map or perform any geomorphic analysis? Do you have the as-built plans for the existing US 93 bridge?

>

>The Project Manager at Flood Control is Greg Jones. Do you need to get approval from the ADOT Project Manager for this data request? Is the ADOT PM Larry Doescher?

>

>Thank you,

>

>Patrick Wolf, P.E.
>Aztec Engineering
>(602) 458-9269
>(602) 458-9359 - fax

>

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Leo Ramos Kreymborg, P.E.
WEST Consultants, Inc.
960 West Elliot Road
Suite 201
Tempe, Arizona 85284
(480) 345-2155
(480) 345-2156 Fax
<http://www.westconsultants.com>

Patrick A. Wolf

From: Victoria Wheeler
Sent: Tuesday, May 24, 2005 10:08 AM
To: Patrick A. Wolf
Subject: FW: Video request

-----Original Message-----

From: Christine Klander [mailto:CKlan334@FOXTV.COM]
Sent: Thursday, May 12, 2005 11:59 AM
To: Victoria Wheeler
Subject: RE: Video request

Victoria:

Can I please get all your contact info; phone, fax and address. The tape is ready, I'll mail it soon. I need you to sign a letter saying the tape with not be rebroadcast, etc. I'll get that to you soon too.

Thanks!

>>> "Victoria Wheeler" <VWheeler@aztec.us> 05/05/05 01:51PM >>>
I understand.Thanks for all your help!

-----Original Message-----

From: Christine Klander [mailto:CKlan334@FOXTV.COM]
Sent: Thursday, May 05, 2005 1:47 PM
To: Victoria Wheeler
Subject: RE: Video request

OK, thanks! I just wanted to make sure, otherwise I would require a subpoena.

I'll let you know when the dub is available.

Christine

Christine M. Klander
Business Manager - News
KSAZ-TV Fox 10
cklan334@foxtv.com
602.262.5157 phone
602.262.5101 fax

>>> "Victoria Wheeler" <VWheeler@aztec.us> 05/05/05 01:38PM >>>
Not at all Christine. For your and the station's peace of mind, here I am sending you our letter to the Flood Control District of Maricopa County. This contains contact names, telephones, and the project number.
You will also find the Final Scope of Work that goes with it, which clearly explains what we are trying to do.

Thanks, and if you have any other concerns, don't hesitate to let me know. We'll be happy to answer them for you.

Victoria

-----Original Message-----

Patrick A. Wolf

From: Leo Kreymborg [leok@westconsultants.com]
Sent: Tuesday, May 24, 2005 7:32 AM
To: Patrick A. Wolf
Cc: Larry Doescher; Greg Jones
Subject: Re: US 93 Bypass

Patrick,

I've uploaded to <ftp://ftpsite.westconsultants.com/Outgoing/Leo/Wickenburg/>

Our draft report as well as our draft models for the existing and proposed conditions Hassayampa River model for the reach near Wickenburg. A figure in the report shows the location of the cross-sections. I can also send you those sections in GIS format.

We have various topography / contour maps sources for the area. What format do you want these in. They are in assorted ArcView shapefiles right now, can you use that format. It will probably be Thursday before I can get them to you.

We also have ArcView TINs of the existing and proposed conditions, these may be easier for you to use if can read them.

Regards,
Leo.

Patrick A. Wolf wrote:

>Leo-
>
>As discussed in our phone conversation yesterday, Aztec is working with Flood
>Control on documenting the recent flooding in Wickenburg, AZ. We understand
>that West Consultants created an existing and proposed condition hydraulic model
>for the US 93 bypass through Wickenburg. Would it be possible to obtain a copy
>of the digital hydraulic models along with any pertinent data (figures, text, etc..)?
>
>Did West Consultants do any supplemental survey along the river? Did you create
>an updated topographic map or perform any geomorphic analysis? Do you
>have the as-built plans for the existing US 93 bridge?
>
>The Project Manager at Flood Control is Greg Jones. Do you need to get approval from
>the ADOT Project Manager for this data request? Is the ADOT PM Larry Doescher?
>
>Thank you,
>
>Patrick Wolf, P.E.
>Aztec Engineering
>(602) 458-9269
>(602) 458-9359 - fax
>
>
>
>

--

Leo Ramos Kreymborg, P.E.
WEST Consultants, Inc.
960 West Elliot Road

Patrick A. Wolf

From: Eric Feldman - FCDX [emf@mail.maricopa.gov]
Sent: Wednesday, May 25, 2005 4:20 PM
To: Patrick A. Wolf
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

The data you requested is ready at the front desk of the Flood Control District of Maricopa County. I have not heard from Greg Jones yet regarding the 2004 topographic data. I provided all the data the GIS Division has at this time.

Eric Feldman
GIS Analyst

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, May 24, 2005 11:13 AM
To: Eric Feldman - FCDX
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

Sorry, here it is.

Patrick

-----Original Message-----

From: Eric Feldman - FCDX [mailto:emf@mail.maricopa.gov]
Sent: Tuesday, May 24, 2005 11:11 AM
To: Patrick A. Wolf
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

There is no attachment for this email, please re-send.

Eric Feldman
GIS Analyst

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, May 24, 2005 11:10 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hassayampa Flooding Study
Subject: Wickenburg / Hassayampa Historic Topo & Aerial Info

Eric-

Here is the border for the mapping info I need for the Hassayampa Post-Flood Study. You already sent Aztec the 2005 aerials and the 2001 Topo Files. I need the older aerial and topographic mapping for whatever years you have. I also need the latest topo information, Greg Jones said there was topo generated in late 2004?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Victoria Wheeler
Sent: Thursday, May 26, 2005 10:54 AM
To: Patrick A. Wolf
Subject: RE: ADOT Contact Prints

11/26/1963
4/13/1977
4/23/1990
10/06/1995
and 2001 (last one taken)

The person's name is Stuart Chase (he goes by Chase)
Phone 602-712-8578 He is very hard to catch. I talked to him a while ago. He might be there.
Enlargements he estimates can be done to about 4 and 1/2 times to still not lose anything along the edges.

Victoria

-----Original Message-----

From: Patrick A. Wolf
Sent: Thursday, May 26, 2005 10:45 AM
To: Victoria Wheeler
Subject: ADOT Contact Prints

Victoria-

Can you give me the contact information for
the person over at ADOT? What years are
these contact prints from?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 9:24 AM
To: ldoescher@dot.state.az.us
Cc: Patrick A. Wolf
Subject: RE: ADOT Contact Prints

Larry,

Can I ask you a favor? I am documenting the flooding that occurred on February 12, 2005. Can you get me a copy of the ADOT photos below. You may find them useful for the Bypass Project as well.

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Thursday, May 26, 2005 10:56 AM
To: Greg Jones - FCDX
Cc: AZ03152 Hasayampa Flooding Study
Subject: FW: ADOT Contact Prints

Greg-

Here is the contact information and flight dates for the contact prints from ADOT.

Thanks,

Patrick

> -----Original Message-----

> **From:** Victoria Wheeler
> **Sent:** Thursday, May 26, 2005 10:54 AM
> **To:** Patrick A. Wolf
> **Subject:** RE: ADOT Contact Prints

>
> 11/26/1963
> 4/13/1977
> 4/23/1990
> 10/06/1995
> and 2001 (last one taken)

>
> The person's name is Stuart Chase (he goes by Chase)
> Phone 602-712-8578 He is very hard to catch. I talked to him a while ago. He might be there.
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> **To:** Victoria Wheeler
> **Subject:** ADOT Contact Prints

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> Thanks,

>

> Patrick Wolf, P.E.
> Aztec Engineering
> (602) 458-9269
> (602) 458-9359 - fax
>

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 9:24 AM
To: Paul Rivers
Cc: Patrick A. Wolf; Eric Feldman - FCDX
Subject: FW: Wickenburg / Hassayampa Historic Topo & Aerial Info

Paul,

Can I ask you to split out some more topo for me?

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, May 24, 2005 11:10 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study
Subject: Wickenburg / Hassayampa Historic Topo & Aerial Info

Eric-

Here is the border for the mapping info I need for the Hassayampa Post-Flood Study. You already sent Aztec the 2005 aerials and the 2001 Topo Files. I need the older aerial and topographic mapping for whatever years you have. I also need the latest topo information, Greg Jones said there was topo generated in late 2004?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 9:43 AM
To: Patrick A. Wolf
Cc: Paul Rivers
Subject: FW: Wickenburg / Hassayampa Historic Topo & Aerial Info

Patrick,

Please send Paul a boundary.

Greg

-----Original Message-----

From: Paul Rivers [mailto:privers@landata.com]
Sent: Friday, May 27, 2005 9:40 AM
To: Greg Jones - FCDX
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

Greg

Depends, send me a boundary of the area in question and I'll see what we can do for you.

Paul Hamilton-Rivers

Vice President of Photogrammetry

Stewart Geo Technologies

(Formerly Landata Airborne Systems, Inc.)

17361 Armstrong Avenue

Irvine, CA 92614-5721

Office: (949) 784-4100

Fax: (949) 784-4101

<mailto:privers@stewart.com>

-----Original Message-----

From: Greg Jones - FCDX [mailto:glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 9:24 AM
To: Paul Rivers
Cc: Patrick A. Wolf; Eric Feldman - FCDX
Subject: FW: Wickenburg / Hassayampa Historic Topo & Aerial Info

Paul,

Can I ask you to split out some more topo for me?

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Tuesday, May 24, 2005 11:10 AM
To: Eric Feldman - FCDX
Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study

Subject: Wickenburg / Hassayampa Historic Topo & Aerial Info

Eric-

Here is the border for the mapping info I need for the Hassayampa Post-Flood Study. You already sent Aztec the 2005 aerials and the 2001 Topo Files. I need the older aerial and topographic mapping for whatever years you have. I also need the latest topo information, Greg Jones said there was topo generated in late 2004?

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 12:29 PM
To: Debbi Shortal - FCDX
Cc: Patrick A. Wolf
Subject: RE:

Debbi,

As to the Stakeholder meeting, there is no need to hold it. We can just send a draft report to the affected agencies.

Sincerely,

Greg

From: Debbi Shortal - FCDX
Sent: Wednesday, May 18, 2005 2:49 PM
To: Greg Jones - FCDX
Subject:

Hi Greg,

I looked for you yesterday and I can see you are quite booked, so just a few comments. As for Aztec, I scribbled on my hard copies of the agenda and toc and did not get copies for you, I am dropping off copies of what I have (I left the CD of the helicopter photos on your desk yesterday). You should receive the meeting minutes and draft invoice. Invoices are scheduled to be through May 12, May 31, and June 30. Draft report will be ready by stakeholder meeting. I went and got a copy of the scope, so I don't ask too many unnecessary questions on the TOC.

The actions requested are:

- Comments on TOC within 1 week
- Contact West Consultants to release info
- Request permission to use FOX 10 video
- Get contact for Hospitality manager to Aztec
- Stakeholders meeting - tentative for June 1(wed) or 2 (thu).

place

who

Info to be presented, sensitive issues?

Also historical aerial photos, which I will go to the warehouse for tomorrow.

Yes, IGA for I-10 basins - I unburied it today and it will be out of here soon!

Thanks, Debbi

6/15/2005

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 12:34 PM
To: Debbi Shortal - FCDX
Cc: Patrick A. Wolf
Subject: RE:

Debbi,

Here are my comments on the Table of Contents:

II. Recommendations of Future Study. Only include if there are any by the Consultant based on issues found.

IV. Data Collection. Delete. The hole report is a data collection effort.

IX. Conclusions. There should not be any or can be combined with Recommendations.

Sincerely,

Greg

From: Debbi Shortal - FCDX
Sent: Wednesday, May 18, 2005 2:49 PM
To: Greg Jones - FCDX
Subject:

Hi Greg,

I looked for you yesterday and I can see you are quite booked, so just a few comments. As for Aztec, I scribbled on my hard copies of the agenda and toc and did not get copies for you, I am dropping off copies of what I have (I left the CD of the helicopter photos on you desk yesterday). You should receive the meeting minutes and draft invoice. Invoices are schedule to be through May 12, May 31, and June 30. Draft report will be ready by stakeholders meeting. I went and got a copy of the scope, so I don't ask too many unnecessary questions on the TOC.

The actions requested are:

- Comments on TOC within 1 week
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- Request permission to use FOX 10 video
- Get contact for Horspitality manager to Aztec
- Stakeholders meeting - tentative for June 1(wed) or 2 (thu).

place

who

Info to be presented, sensitive issues?

Also historical aerial photos, which I will go to the warehouse for tomorrow.

Yes , IGA for I-10 basins - I unburied it today and it will be out of here soon!

Thanks, Debbi

Patrick A. Wolf

From: Debbi Shortal - FCDX [dls@mail.maricopa.gov]
Sent: Friday, May 27, 2005 3:37 PM
To: Patrick A. Wolf
Subject: Hassayampa PFS

Hello Patrick,

The aerial photo has been scanned and is ready for your pick-up, it should be 1957, I will verify. I tried to email it but the file is too big. Victoria Wheeler has requested more photos, I will try to locate them next Wednesday. As for the stakeholders meeting, Greg says we won't need to have one, we will send draft reports to all involved and take comments. Here are his comments on the TOC:

II. Recommendations of Future Study. Only include if there are any by the Consultant based on issues found.

IV. Data Collection. Delete. The whole report is a data collection effort.

IX. Conclusions. There should not be any or can be combined with Recommendations.

I assume the exhibits that are mentioned in the scope are also a part of this, or have they changed?

Thank You,

Debbi Shortal
Planner Intern
Planning & Project Management Division
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009
602-506-1034
dls@mail.maricopa.gov
www.fcd.maricopa.gov

Patrick A. Wolf

From: Victoria Wheeler
Sent: Tuesday, May 31, 2005 3:37 PM
To: Tony Bokich; Patrick A. Wolf
Subject: FW: Hassayampa River Photos

This is from the person at the bridge management dpt at ADOT. We'll see what we get.

Victoria

-----Original Message-----

From: Clifton Guest [mailto:CGuest@azdot.gov]
Sent: Tuesday, May 31, 2005 2:19 PM
To: Victoria Wheeler
Subject: Hassayampa River Photos

The requested photos were sent via mail today.

Thanks,

Clifton Guest
ADOT Bridge Management

Patrick A. Wolf

From: Leo Kreymborg [leok@westconsultants.com]
Sent: Monday, June 06, 2005 5:16 PM
To: Patrick A. Wolf
Cc: Greg Jones
Subject: Re: US 93 Bypass

Patrick,

I've upload the topography and cross-sections to our ftp site. The topo is in dgn format as breaklines + masspoints, and also in shapefile format as 1 foot contours + masspoints.

<ftp://ftpsite.westconsultants.com/Outgoing/Leo/PatrickWolf/>

I would recommend using the contours + masspoints overall, because the breaklines, for example, show the top of the bridge decks for the Hassayampa River bridges. The contours show the channel bottom.

Also on the ftp site is a spreadsheet which calculates the elevation of the bed, based on the ADOT surveys. The spreadsheet assumes that the low chord is a straight line between the between the each end of the bridge and the center, when in fact it is an arc. This introduces a small amount of error, but for what I was using it for I didn't think it mattered. The low chords were surveyed in 2004.

Note that the coordinates are ground coordinates, not state plane. A simply scaling of the x and y coordinates, both by the same factor, turns it into state plane, see the readme.txt file.

Don't hesitate to call if you have any questions or if there is anything else I can provide.

Regards,
Leo.

Patrick A. Wolf wrote:

>Leo-
>

>As discussed in our phone conversation yesterday, Aztec is working with Flood Control on documenting the recent flooding in Wickenburg, AZ. We understand that West Consultants created an existing and proposed condition hydraulic model for the US 93 bypass through Wickenburg. Would it be possible to obtain a copy of the digital hydraulic models along with any pertinent data (figures, text, etc..)?

>
>Did West Consultants do any supplemental survey along the river? Did you create an updated topographic map or perform any geomorphic analysis? Do you have the as-built plans for the existing US 93 bridge?

>
>The Project Manager at Flood Control is Greg Jones. Do you need to get approval from the ADOT Project Manager for this data request? Is the ADOT PM Larry Doescher?

>
>Thank you,

>
>Patrick Wolf, P.E.
>Aztec Engineering
>(602) 458-9269
>(602) 458-9359 - fax

>
>

>
>
>

--
Leo Ramos Kreymborg, P.E.
WEST Consultants, Inc.
960 West Elliot Road
Suite 201
Tempe, Arizona 85284
(480) 345-2155
(480) 345-2156 Fax
<http://www.westconsultants.com>

Patrick A. Wolf

From: Victoria Wheeler
Sent: Tuesday, June 07, 2005 12:49 PM
To: Patrick A. Wolf
Subject: FW: MC Flood Control District

-----Original Message-----

From: Victoria Wheeler
Sent: Tuesday, June 07, 2005 12:41 PM
To: Tony Bokich
Subject: RE: MC Flood Control District

Yes Tony. I did get in touch with her already. She is out of town, on her cell; probably didn't get all my info, but she will call me tomorrow to verify the case numbers and contact persons with phone numbers. I also talked to Ray Johns (the elder man who lost his house). He will do anything to help me, only that we are a little short of time now. His attorney has all his good pictures right now. He is about 19 miles from Wickenburg. Ray asked me to check with him in a couple of days, since he will need to coordinate with him to go get them. Then he'll call me and says I can go meet him and then he and I can go get duplicates on the spot. He says I can call him anytime. I'll follow up to remind him. He's got pictures of the berm that other man built, and pictures of how the water was turning as it hit it.

-----Original Message-----

From: Tony Bokich
Sent: Tuesday, June 07, 2005 12:30 PM
To: Kristin Michael; Jon Faltis
Cc: Donna Wiggall; Marina Korp; Victoria Wheeler
Subject: RE: MC Flood Control District

It was most likely Victoria. She is trying to get in touch with Ms. Sullivan.

-----Original Message-----

From: Kristin Michael
Sent: Tuesday, June 07, 2005 11:51 AM
To: Jon Faltis
Cc: Donna Wiggall; Tony Bokich; Marina Korp
Subject: RE: MC Flood Control District

It wasn't me - Kristin

-----Original Message-----

From: Jon Faltis
Sent: Tuesday, June 07, 2005 11:49 AM
To: Donna Wiggall
Cc: Kristin Michael; Marina Korp
Subject: RE: MC Flood Control District

It might be Kristin. The only project I know of for Flood Control is the Tony Bokich project - Hassayampa. Kristin, Tony, and I have been working on some things with that project.

Jon Faltis
Contract Administrator
AZTEC Engineering
4561 E. McDowell Rd.
Phoenix, AZ 85008-4505
602-458-7475 Direct
602-458-7477 Fax
jfaltis@aztec.us

-----Original Message-----

From: Donna Wiggall
Sent: Tuesday, June 07, 2005 11:00 AM
To: ALL-PHOENIX
Subject: MC Flood Control District

I just received a phone call from **Janice Sullivan** at **Horspitality** who said she received a somewhat urgent call from a female that did not leave her name or a return phone number. It is related to MC Flood Control District. She said that she will be out of town for several days and to contact her **(928) 232-9007**

Donna A. Wiggall
Director of Administration
AZTEC Engineering
4561 E. McDowell Road
Phoenix, AZ 85008
P: (602) 458-7485
F: (602) 458-7477
dwiggall@aztec.us

Patrick A. Wolf

From: Greg Jones - FCDX [glj@mail.maricopa.gov]
Sent: Monday, June 13, 2005 1:10 PM
To: Patrick A. Wolf
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

Patrick,

I have the Fox coverage down at the Desk for your pickup. I am still working on ADOT.

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@aztec.us]
Sent: Friday, May 27, 2005 10:23 AM
To: Greg Jones - FCDX
Cc: Paul Rivers
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

Paul-

Here is the boundary file.

Thanks,

Patrick Wolf, P.E.
Aztec Engineering
(602) 458-9269
(602) 458-9359 - fax

-----Original Message-----

From: Greg Jones - FCDX [mailto:glj@mail.maricopa.gov]
Sent: Friday, May 27, 2005 9:43 AM
To: Patrick A. Wolf
Cc: Paul Rivers
Subject: FW: Wickenburg / Hassayampa Historic Topo & Aerial Info

Patrick,

Please send Paul a boundary.

Greg

-----Original Message-----

From: Paul Rivers [mailto:privers@landata.com]
Sent: Friday, May 27, 2005 9:40 AM
To: Greg Jones - FCDX
Subject: RE: Wickenburg / Hassayampa Historic Topo & Aerial Info

Greg

Depends, send me a boundary of the area in question and I'll see what we can do for you.

Paul Hamilton-Rivers

Vice President of Photogrammetry

Stewart Geo Technologies

(Formerly Landata Airborne Systems, Inc.)

17361 Armstrong Avenue

Irvine, CA 92614-5721

Office: (949) 784-4100

Fax: (949) 784-4101

<mailto:privers@stewart.com>

-----Original Message-----

From: Greg Jones - FCDX [mailto:glj@mail.maricopa.gov]

Sent: Friday, May 27, 2005 9:24 AM

To: Paul Rivers

Cc: Patrick A. Wolf; Eric Feldman - FCDX

Subject: FW: Wickenburg / Hassayampa Historic Topo & Aerial Info

Paul,

Can I ask you to split out some more topo for me?

Greg

-----Original Message-----

From: Patrick A. Wolf [mailto:PWolf@gaztec.us]

Sent: Tuesday, May 24, 2005 11:10 AM

To: Eric Feldman - FCDX

Cc: Greg Jones - FCDX; AZ03152 Hasayampa Flooding Study

Subject: Wickenburg / Hassayampa Historic Topo & Aerial Info

Eric-

Here is the border for the mapping info I need for the Hassayampa Post-Flood Study. You already sent Aztec the 2005 aerials and the 2001 Topo Files. I need the older aerial and topographic mapping for whatever years you have. I also need the latest topo information, Greg Jones said there was topo generated in late 2004?

Thanks,

Patrick Wolf, P.E.

Aztec Engineering

(602) 458-9269

(602) 458-9359 - fax

Patrick A. Wolf

From: Human Resource [HRD@ci.wickenburg.az.us]
Sent: Tuesday, June 14, 2005 12:16 PM
To: Patrick A. Wolf
Subject: Letter to ADEM

Attached please find our appeal letter to ADEM to FEMA. If you have any questions, please let me know.

Thanks,
Amy Brown
Town of Wickenburg
Administrative Assistant/Human Resources Analyst
(928) 684-5451 Ext. 522



A.12 Newspaper Articles (February 2005 Flood)

THE WICKENBURG SUN



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Tuesday April 19, 2005

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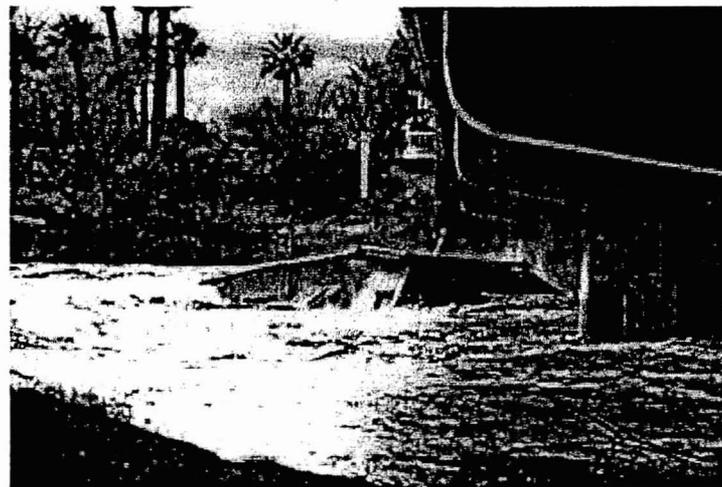
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Archives
Originally posted to the web in News, on Wednesday, February 16, 2005 1:18 PM CST.

Hassayampa swallows homes, structures

By Janet DelTufo, Staff Writer



Johns' home about to slip under Hassayampa Bridge

Mayor Ron Badowski officially declared Wickenburg a state of emergency Saturday after four structures and a portion of Jack Burden Road were swept into the swift-moving Hassayampa River.

Onlookers watched in disbelief as Ray Johns' home of 24 years sank and rapidly disappeared underneath the Hassayampa bridge after almost three inches of rain hit the local area all day Friday and early Saturday morning.

There were no injuries reported, but a guest house, a trailer, a shed, and an inoperable car were also pulled into the river by rushing waters. The town lost water lines and a pressure tank, and two more homes are in danger of being lost.

"By filing the proper emergency documents, we will qualify for some county, state and federal



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aid," Badowski said. "We have some major infrastructure dollars to replace."

Erosion along Jack Burden Road has been building for many years, and last month Ray Johns approached the Wickenburg Town Council with photographs of the deterioration of the road just north of his home.

Johns seemed to know that it was only a matter of time before disaster came his way, and now he and several other individuals are in the process of rebuilding their lives.

Johns, who lived alone with his dog, will move into a 32-foot travel trailer that was donated to him. He lost both his main house and his back house, but was in good spirits a few days after the incident.

"You have to take it as it comes," he said. "I'm OK, and I'm going to be just fine."

Johns said he was watching television Saturday when he realized that he needed to get out of the house. He was only able to grab a few belongings and his dog before the house dropped into the river.

Greg and Debbie Welna lost what they referred to as their back house, where Greg slept last Friday night while it rained. By mid-morning, he said he felt as though the water level had crested, and he left to do an errand in the Valley. When he arrived back home, the back house was gone, and his wife Debbie was in a state of shock.

The Welnas didn't know at the time if it was feasible to keep their main house, but town officials recently said no \$ their white house hanging on the edge of the river is a complete loss.

Bill and Mare Nubson were able to save their trailer but lost all their belongings that were in an adjacent shed. They were able to save their two dogs, two of their cats, and five birds. They was back in the area the following day looking for one gray cat.

James and Lorrene Messerly reside in the Desert Cypress Trailer Park, and their mobile home is going to be moved from its current location. The back corner of its adjacent shed is hanging over the running river, but officials believe the home can be saved.

Officials say the mobile home next to the Messerly's that was stuck by a power pole will most likely be determined a total loss. It is also going to be moved this week.

More than four years ago, Johns had performed some bank reinforcement below his house. But that reinforcement could not withstand what county officials referred to as a 10- to 20-year flood event.

"I'd say that most rivers like the Hassayampa, if it rained a 100-year event, would see a lot of the area erode because it would be covered with water," said Timothy Phillips of the Flood Control District of Maricopa County. "This is probably just a general statement, but because the river hasn't run real heavy for many years, it has cut a low-flow channel for the normal runoff.

When you get a significant event, it's starts to erode back into that area, which is part of the 100-year flood plain."

The area that flooded last week has structures that were built before strict building regulations were put in place. Johns' property is now considered river bottom, and he will not be allowed to rebuild there.

Town officials said erosion from underneath ground level caused the foundation to weaken. The town is now looking into erosion control and will work closely with county flood control.

Town Manager Shane Dille said the embankment along Jack Burden Road needs to be firmed up, and the town wants to get to that task as quickly as possible.

Water has been running in the Hassayampa River for more than a month, and the town and county cannot start working on the banks until the river has dried.

Dille said the town was looking at possibly placing a berm near the east bank to clear the water faster. However, Dille knows that building a berm is not an easy process and one that could bring harm to the other side of the river.

County officials will be working with local officials on infrastructure issues, and the construction division of the United States Army Corps of Engineers will not be called in unless requested by Governor Janet Napolitano on behalf of the Division of Emergency Services.

Spokesperson Joe Dixon said that the Corps of Engineers could help in several ways, including providing technical assistance.

More rain is expected this week, and town crews will be on hand in case of emergency. Mayor Badowski praised emergency workers for their coordinated effort last week.

"They (town employees) deserve a lot of credit," Badowski said. "They were out overnight on Saturday, and they put in place an emergency road. Everyone has done a great job."

The Wickenburg Volunteer Fire Department stood vigil at the site for about 48 hours straight, ensuring the safety of the community.

Photo taglines for jump:

Inoperable car along pulled into the raging river

Mayor Badowski interviewed by Phoenix TV

Photos by Janet DeTufo

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THE WICKENBURG SUN



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Archives

Originally posted to the web in News, on Wednesday, February 16, 2005 1:18 PM CST.

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Officials ask for consideration of trailer park residents

By Janet DelTufo, Staff Writer

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Aerial photograph shows loss of Jack Burden Road, threatened homes

While town officials explore alternate access routes to Jack Burden Road following recent flood damage, they are asking those who are using Desert Cypress Trailer Ranch as a temporary detour to be considerate of the park's residents.

"We are asking the community to respect this quiet residential area," said Wickenburg Town Manager Shane Dille. "We need the people who work at Remuda Ranch and property owners who need to use this detour to drive slowly and be cautious."

Dille also asked residents not to come to the trailer park without a legitimate reason. He said the park was not the place to satisfy one's curiosity.

"For those who just want to see what's going on, this is not your



destination," the town manager warned.

Dille said the town is looking for an alternate route for accessing Jack Burden Road. The town realizes it cannot continue to direct traffic through the trailer park for any extended length of time.

Officials are also concerned with a portion of Jack Burden Road that has been showing signs of erosion and instability. It is located just north of the portion of Jack Burden Road that was lost in the flood.

"Our primary concern is to protect Jack Burden Road and to provide public access and emergency response," Dille said. "But our immediate concern is getting water to all the residents."

A number of homes in the flooded area had been without water, but officials said that by today (Wednesday, Feb. 16) water should be restored to all homes. However, those customers who were without water that is just restored will be under a mandatory boil order.

Town officials say the water is safe for showering, washing dishes and for doing laundry. Drinking water will need to be boiled until it has been tested as safe.

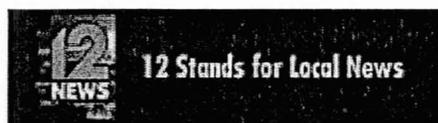
CostCo donated 10,000 gallons of water through Arizona Public Service, and it was delivered by the town's public works department.

As for other utilities, electricity from APS has been fully restored. Telephone service should be fully restored, and Southwest Gas is hoping to have service fully restored by today.

All of the utilities are being restored on a temporary basis. Once the river is dry, permanent repairs can be made.

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Heavy rain possible, flash flood watch issued

azcentral.com
Feb. 18, 2005 04:42 PM

Watch Bill's forecast

A flash flood watch was issued for the Valley Friday afternoon and will continue through Saturday afternoon as a Pacific storm brings widespread showers, a chance of thunderstorms and possibly heavy rain, forecasters said.

The flash flood watch also extends to northwest and northeast Maricopa County and most of the northern part of the state. A flash flood watch means that flooding is possible but not certain.

Rain, heavy at times, is expected over the region from Friday afternoon into Saturday, the National Weather Service reported. Snow, heavy at times, is expected to start Friday night at elevations above 7,000 feet, with 3 to 6 inches on the ground by Saturday morning.

The heaviest rainfall is expected to be in a swath from the Grand Canyon to Payson, including Flagstaff, Prescott and Sedona. One to 2 inches of rain is likely in those cities, and locally higher amounts possible, pushing streams near or above flood stage, forecasters said.

The Valley may get more than an inch of rain from the storm, which would be enough to cause flooding on ground still wet from last week's storm, the weather service said.

Isolated thunderstorms could produce brief but locally heavy rain, which could quickly fill normally dry washes and small streams, so forecasters urged motorists to keep up with weather reports and stay out of washes with running water or barricades.

Overnight precipitation in the Valley was .23 inch. That brings the Valley to 3.28 inches of rainfall so far this year compared to 1.27 inches in a normal year.

Friday night's forecast calls for an 80 percent chance of showers, with heavy rain possible. The low will be 54

Showers are likely on Saturday, with a chance of thunderstorms, and heavy rain is possible, forecasters said. The chance of rain is 80 percent during the day but declines to 40 percent at night. The high will be 63 and the low 51.

It doesn't end there. The storm, which earlier had been expected to clear out Tuesday, now is expected to linger through Thursday.

On Sunday, there's 40 percent chance of showers during the day, slipping to 20 percent at night. The high will be 63 and the low 49.

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- Check the forecast
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- Here comes the rain
- Send us your weather photos
- Special report: Arizona's long, dry streak

For the Presidents Day holiday on Monday, look for mostly cloudy skies and a 20 percent chance of showers during the day but a 60 percent chance of showers at night. The high will be 64 and the low 50.

On Tuesday, there's a 60 percent chance of rain, and Wednesday and Thursday have a 20 percent chance of rain. Highs will be in the 60s and lows could dip to the upper 30s.

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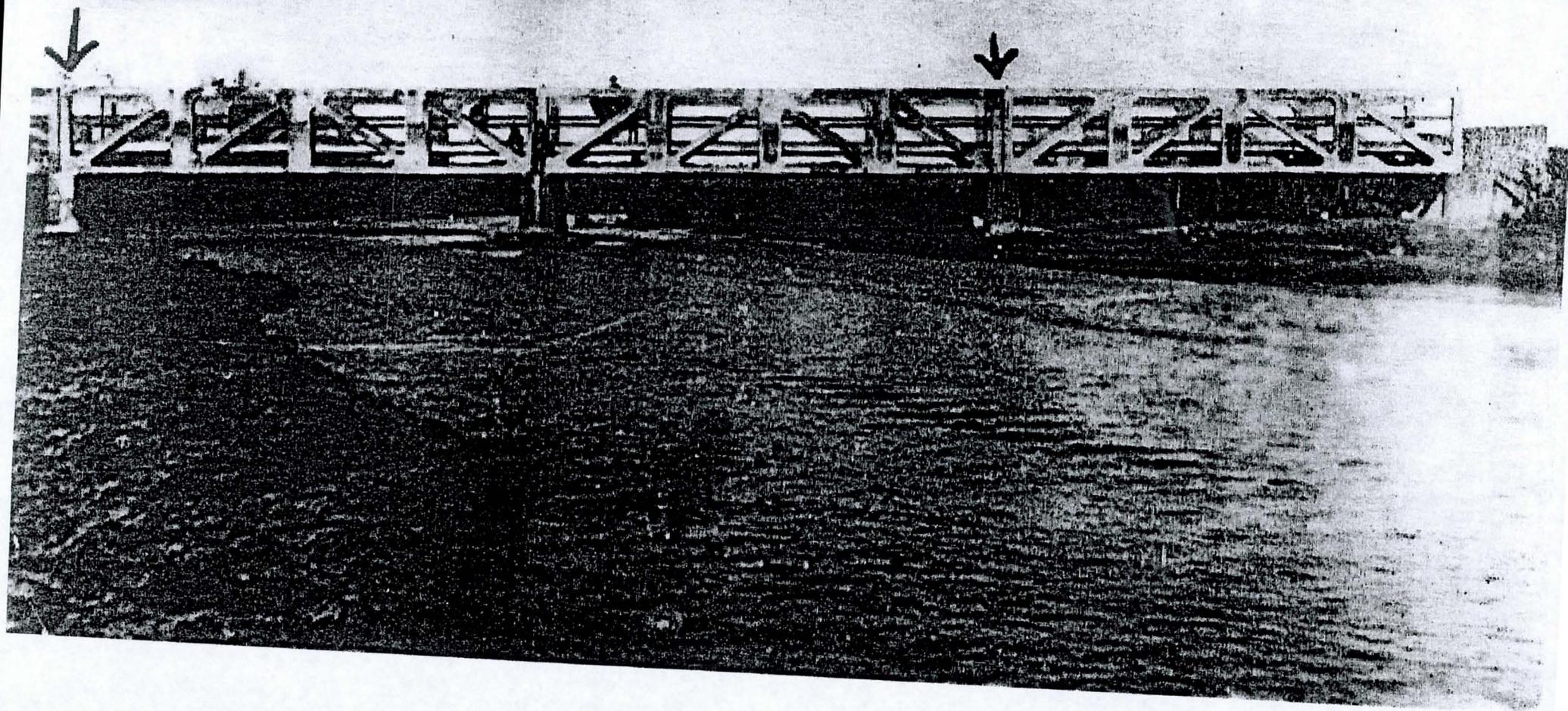


A.13 Historic Flood Photos

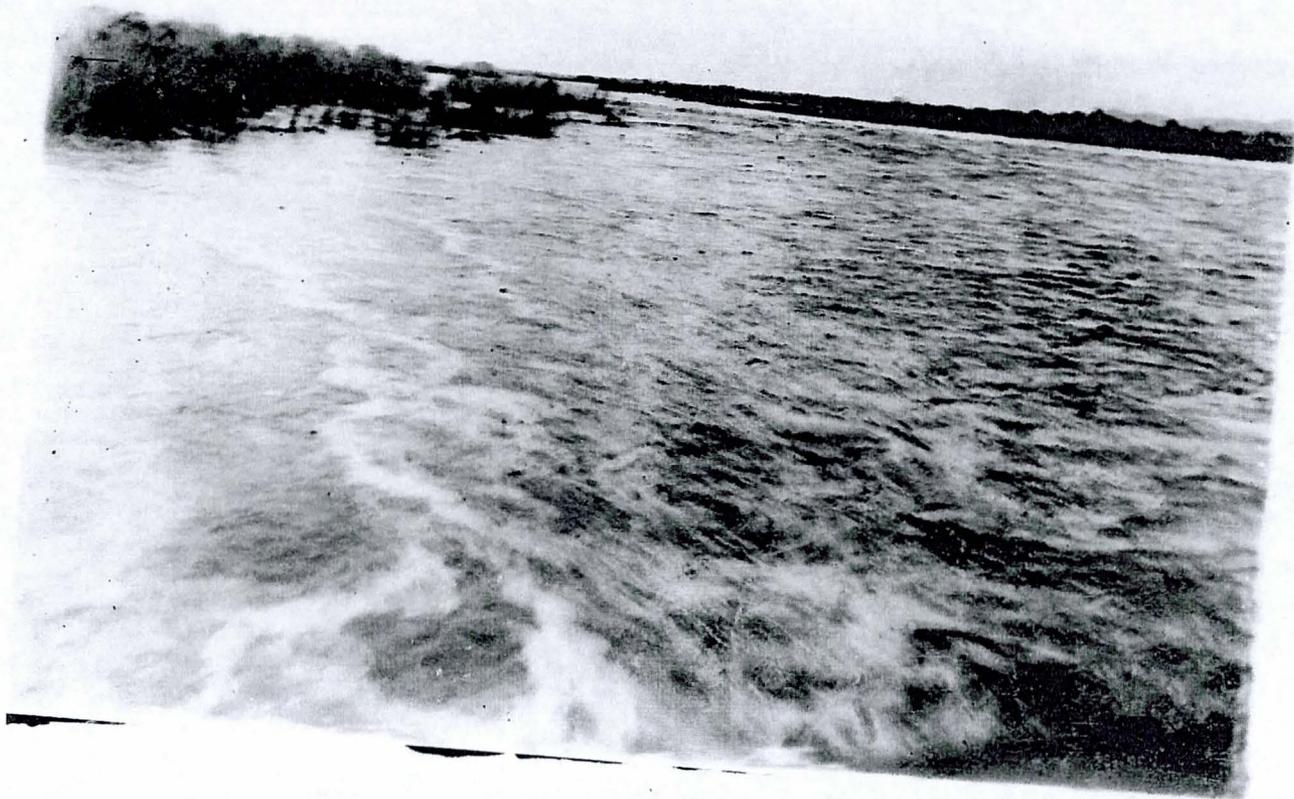
Concrete Bridge over Nassayampa River, Wickenburg, Ariz.

1078.

— OUT IN 1916 —



-1929-



7/15/64

Powder House Wash
Buried car at
Philbeck Residence.



10



Powder House Wash
flooded car in
motel yard, East
Wickenburg.



Wickenburg Sun, 9/10/70

Taken at 4:00 Saturday afternoon (Sept 5). The river started to recede shortly afterward.



Wickenburg Sun, 9/10/70

The devastating Hassayampa has all the appearance of a quiet, peaceful lake in this photograph of Max Kirkpatrick's horse operation between Chestnut St. and Remuda Ranch.



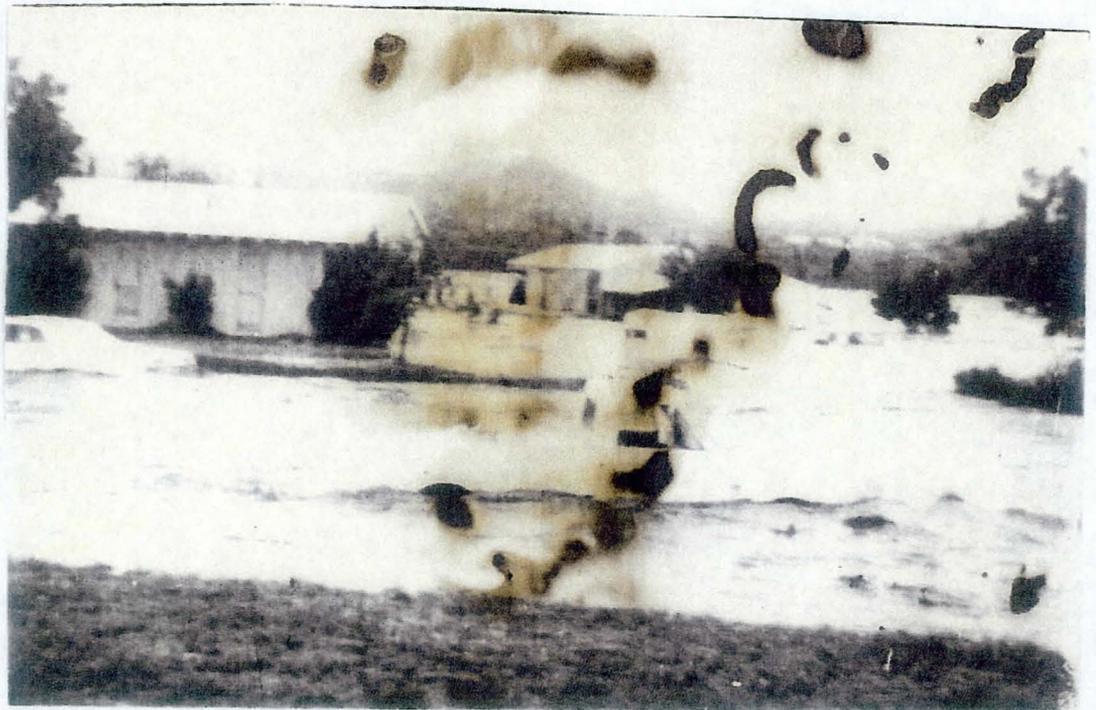
Wickenburg Sun, 9/10/70

Rescue operation on Chestnut St. Eight-year-old Marie Hopkins is carried by Earl Herber who clings to cable stretched just above the rushing waters. Dave Underdown (left corner) is holding to the cable. Other volunteer helper, center, is not identified. Marie is the daughter of Mrs. Pat White, waitress at the Bar 7 Restaurant.



Wickenburg Sun, 9/10/70

Another view of Chestnut Street at the height of Saturday's (Sept 5) flood

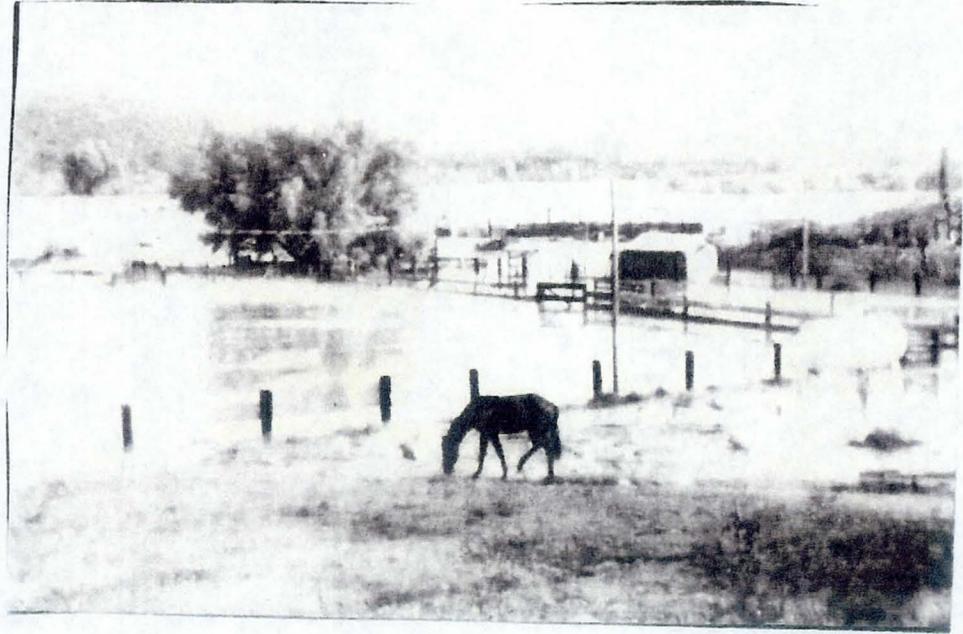


Wickenburg Sun, 9/10/70

Home of P. L. Kinnick, disabled World War II veteran, once stood on this spot along the Phoenix Hwy near Monarch Wash. Now it is gone, washed away and shattered into kindling wood against the thicket on the far left. Remains of camper in center background.

Wickenburg Sun 9/10/70

Cut Rock Ranch corrals flooded.



Wickenburg Sun 9/10/70

Roadside park on Phoenix Hwy in shambles. Surfaced roads gone, trees and shrubs uprooted and fireplaces demolished.



Wickenburg Sun 9/10/70

Pickup truck of Mayor Brown's Wickenburg Plumbing is here seen as it was about to be carried under the bridge. The truck would up off shore near Watkins Chevrolet.



Wickenburg Sun 9/10/70

This home and yard on Chestnut Street caught the full fury of the raging waters which left behind trash and refuse, as this Sunday morning photo shows.



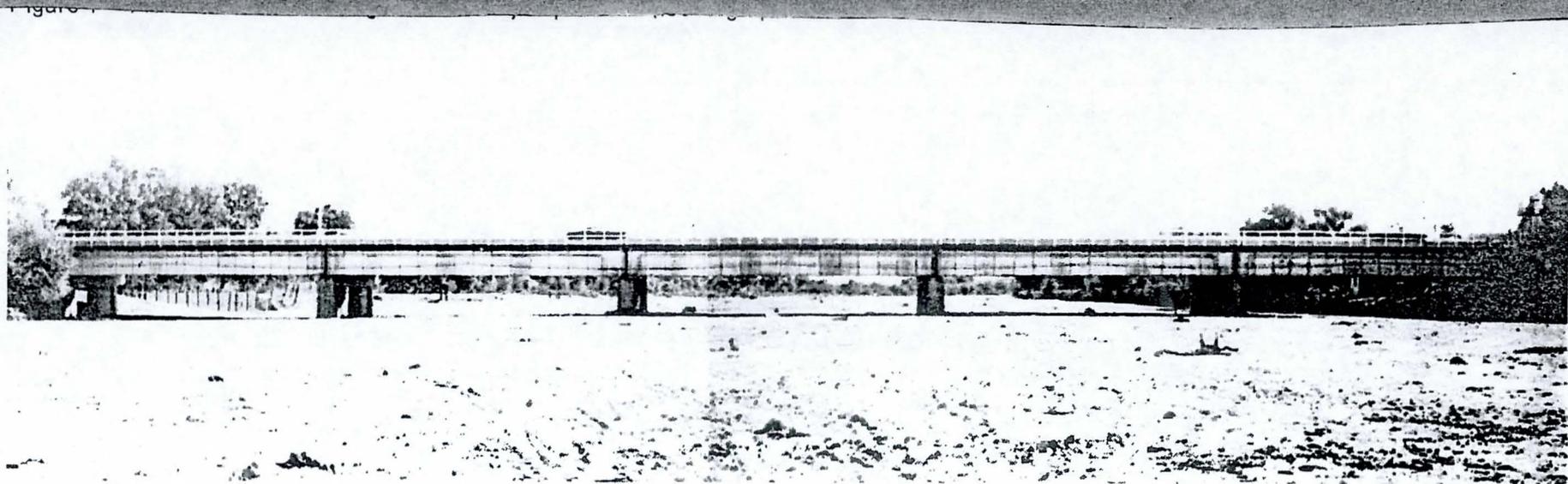
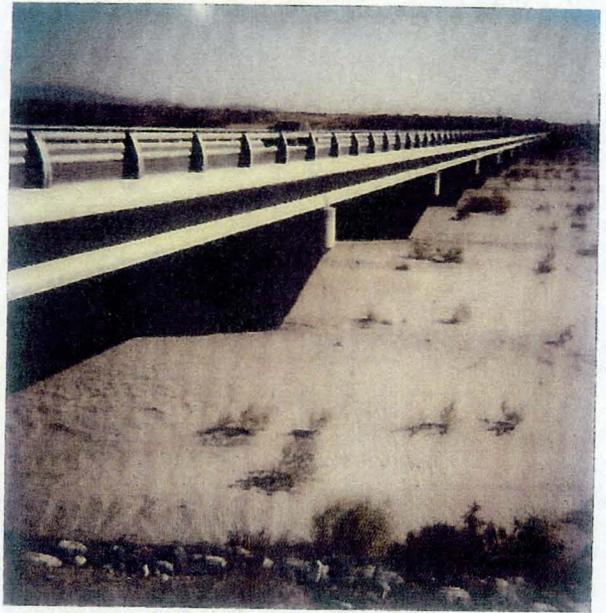
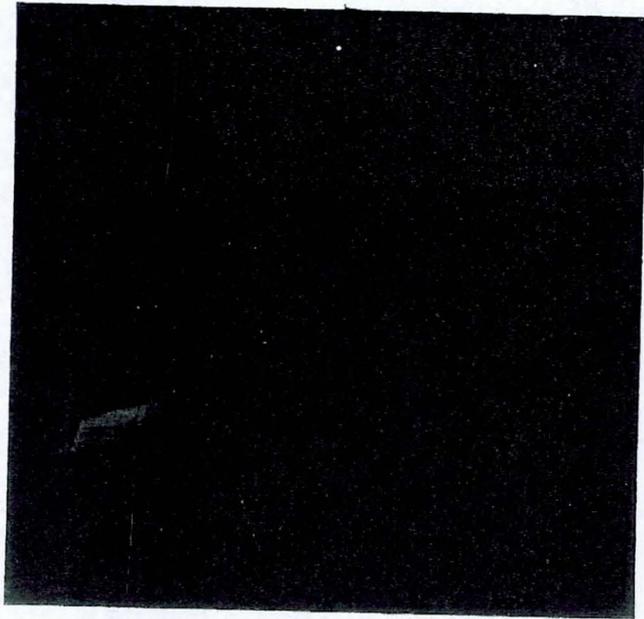


Figure 2 — Highway 60, 70, 89, 93 bridge over Hassayampa River (looking downstream at river mile 47.63).





HASSAYAMPA RIVER AT I-10
BRIDGE STANDING IN THE MED-
IUM AT THE WEST END OF THE
BRIDGES FACING EAST 11-29-80
RBB

2/16/80
PHOTO # 12 HASSAYAMPA RIVER 1200 FE
STANDING ON THE UPSTREAM SIDE OF THE
BRIDGE, STANDING IN THE CENTER OF THE
BRIDGE, THE RIGHT BANK OR WEST BANK
IS SHOWN IN THE PHOTO

HASSAYAMPA RIVER
FLOODING
2/16/80 ADM JMP

ADM JMP



Photo # 11 Hassayampa River 2/16/80
1200 ft
STANDING ON THE UPSTREAM SIDE OF THE
CENTRE OF THE BRIDGE, PHOTO WAS TAKEN
OF THE LEFT BANK AREA UPSTREAM OF THE
BRIDGE, AT WICKESBURG

HASSAYAMPA RIVER
FLOODING
2/16/80 ADM JMP

JMP

Photo # 13 Hassayampa River 2/16/80
1200 ft
AT WICKESBURG
STANDING ON THE SOUTH EDGE OF THE
BRIDGE AND EAST END OF THE BRIDGE
FACING DOWNSTREAM, FLOW AVERAGES
6" DEEP & IS FLOWING 300' WIDE
AT 5 FEET PER SECOND.

HASSAYAMPA RIVER
FLOODING
2/16/80 ADM JMP

JMP



17

LOOKING EAST
WEST STREAM OF
HASSAYAMPA AT
BASELINE Rd.

FLOOD CONTROL DISTRICT
DEPT.

HASSAYAMPA
LANDSCAPE
3/6/80 ADM JMP

0573031

18

LOOKING WEST
EAST STREAM OF
HASSAYAMPA AT
BASELINE Rd.

HASSAYAMPA
LANDSCAPE
3/6/80 ADM JMP

0573031



HASSAYAMPA RIVER
BRIDGE
11/24/80 ADM JMP

*See West Bridge 74
1-12-81 from photo
Looking from west side
of structure
and bridge 74*

HASSAYAMPA RIVER
BRIDGE
11/24/80 ADM JMP

*HASSAYAMPA RIVER AT
INTERSTATE-10 - STANDING
AT THE WEST END OF THE ~~BRIDGE~~
BRIDGES FACING EAST - GUNGE
IS PAINTED ON THE WEST BOUND
BRIDGE*



HASSAYAMPA RIVER
BRIDGE
11/24/80 ADM JMP

HASSAYAMPA RIVER

#2

HASSAYAMPA RIVER
BRIDGE
11/24/80 ADM JMP

5025 WASH BRIDGE ON NW^{1/4}
STATE HIGHWAY 74 STANDING
UPSTREAM OF SOUTH END OF BRIDGE



LOOKING SOUTH DOWN
HASSAYAMPA AT
CONFLUENCE OF GILA RIVER

FLOOD CONTROL DISTRICT
RECEIVED

HASSAYAMPA
LANDSCAPE
3/6/80 ADM JMP

1
5
1
5
6
5
1

LOOKING WEST
HASSAYAMPA CROSSING
AT TONOPAH - SALOME
HWY

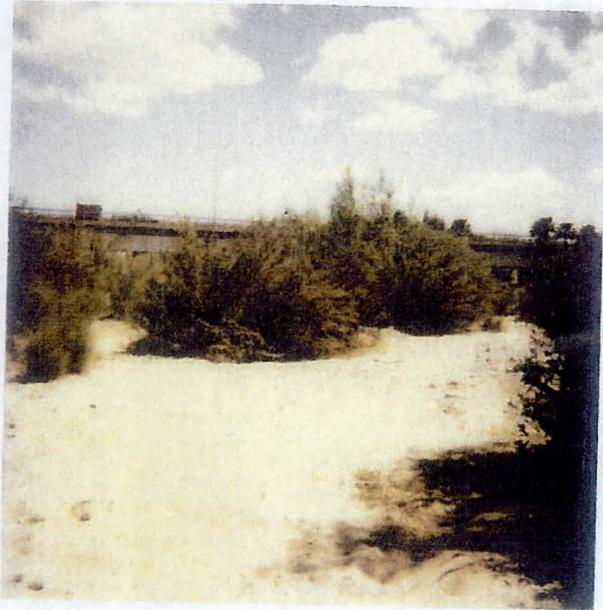
FLOOD CONTROL DISTRICT

HASSAYAMPA
LANDSCAPE
3/6/80 ADM JMP

1
5
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5
1

April 1989

Hassayampa River



48



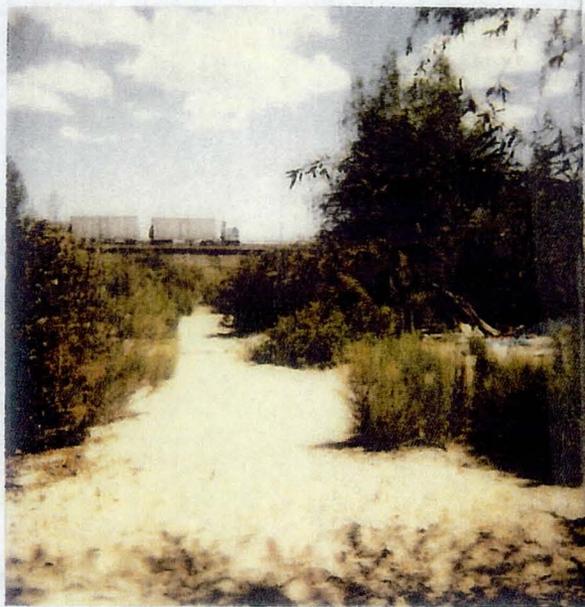
April 1989 Hassayampa River

42



April 1989

Hassayampa River



50



3/5/93



ADOT Rest Area along the Hassayampa R.
Looking upstream

Arrow marks debris line 3/5/93

3/5/93



84

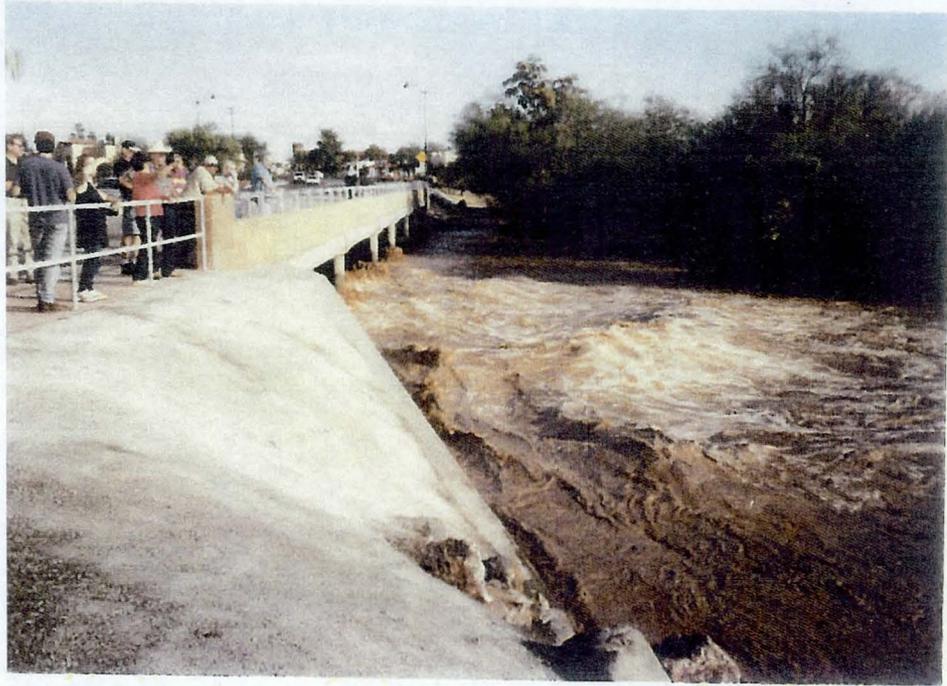
ADOT Rest Area along the Hassayampa R.
Looking upstream in both pictures
Arrow marks debris line
3/5/93

85

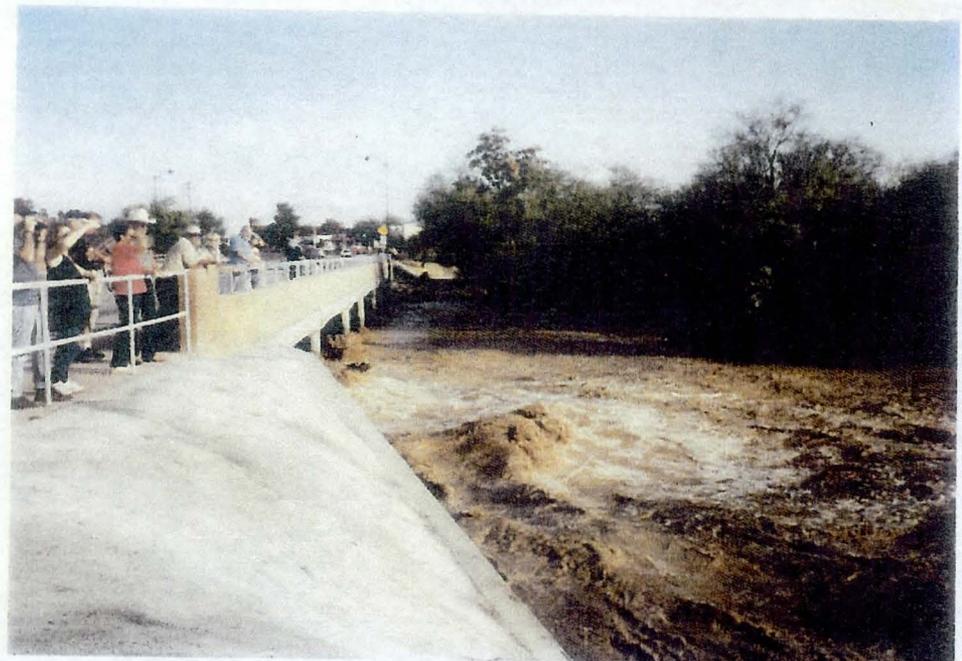
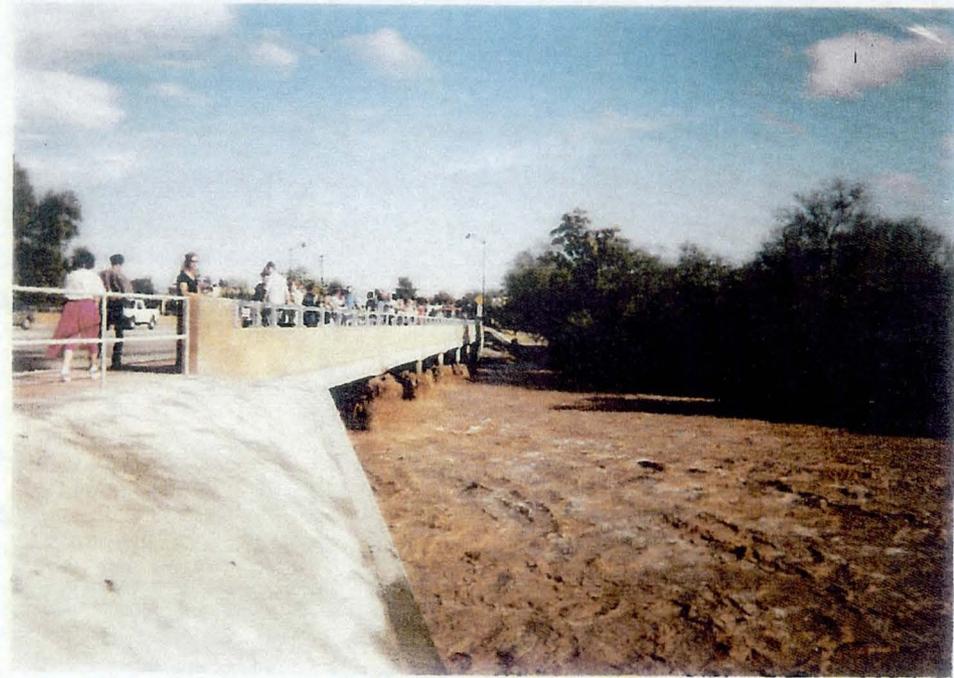
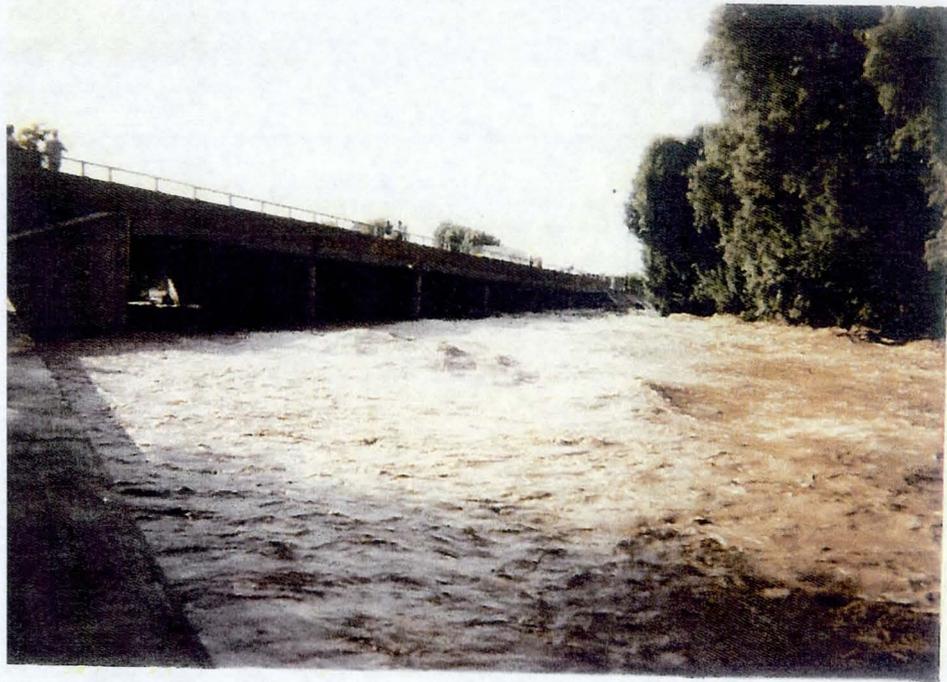






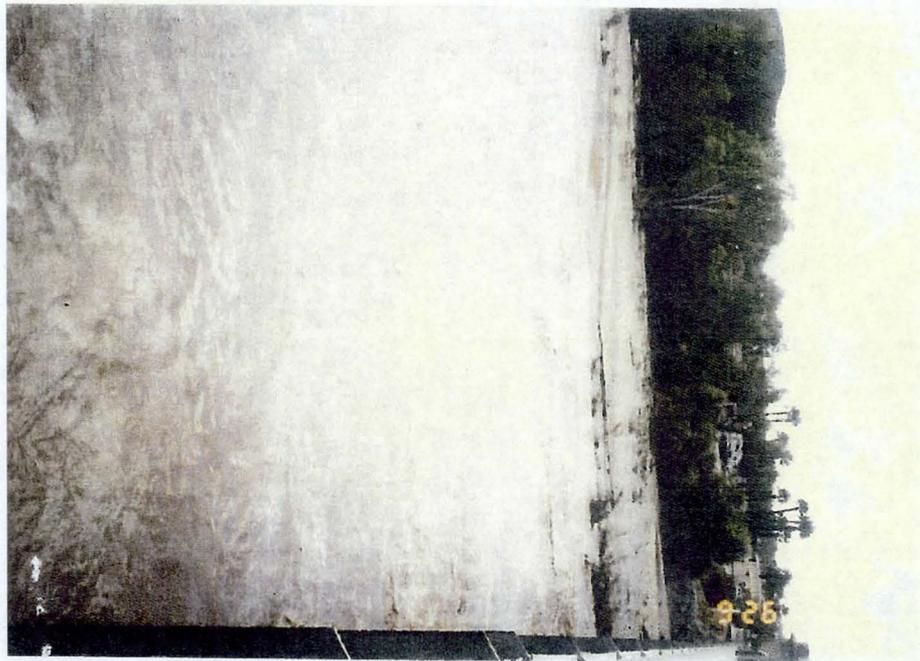








C-LINE #52584
35MM PRINTS



AGUILA FLOODING
NORA STORM
9-26-97 REG MWD

WICKENBURG
HASSAYAMPA R., U.S. 60, LOOKING SOUTH

4-8

12:15 PM ±

AGUILA FLOODING
NORA STORM
9-26-97 REG MWD

WICKENBURG
HASSAYAMPA R., U.S. 60, LOOKING S.E.

4-7

12:10 PM

AGUILA FLOODING
NORA STORM
9-26-97 REG MWD

WICKENBURG
HASSAYAMPA R., U.S. 60, LOOKING

4-10

12:15 PM ±

N.W.

AGUILA FLOODING
NORA STORM
9-26-97 REG MWD

WICKENBURG
HASSAYAMPA R., U.S. 60, LOOKING S.W.

4-9

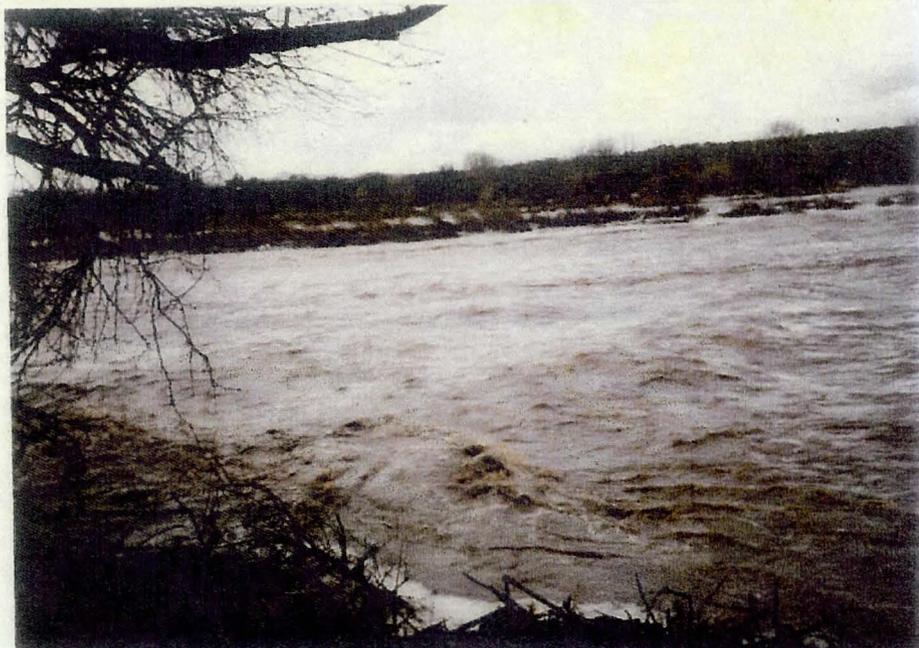
12:15 PM ±

C-LINE #52584
35MM PRINTS



AGUILA FLOODING
NORA STORM
9-26-97 REG MWD
WICKENBURG
4-12
12:18 PM
HASSA XIMPO R., U.S. 60, LOOKING N.E.

AGUILA FLOODING
NORA STORM
9-26-97 REG MWD
WICKENBURG
4-11
12:15 PM
KASSHAMP R., U.S. 60, LOOKING UPSTREAM



Wickenburg
US 60 & HASSY Road
S.W. Bank of Bridge

Wickenburg
S.E. Bank of US 60 and
HASSY Road Bridge
Down Stream

Wickenburg
Looking South on
US 60 and HASSY Road
Bridge (Down Stream)

Wickenburg
South side of US 60 and
HASSY Road Bridge



4th St Looking East

163

WICKENBURG, CENTENNIAL

9/6/00 ENG SDW

#3

164

WICKENBURG, CENTENNIAL

9/6/00 ENG SDW

Don't remember name of st ¹⁶⁶
but it's the farthest south street
in warden to 4th st. #1 or #3

WICKENBURG, CENTENNIAL

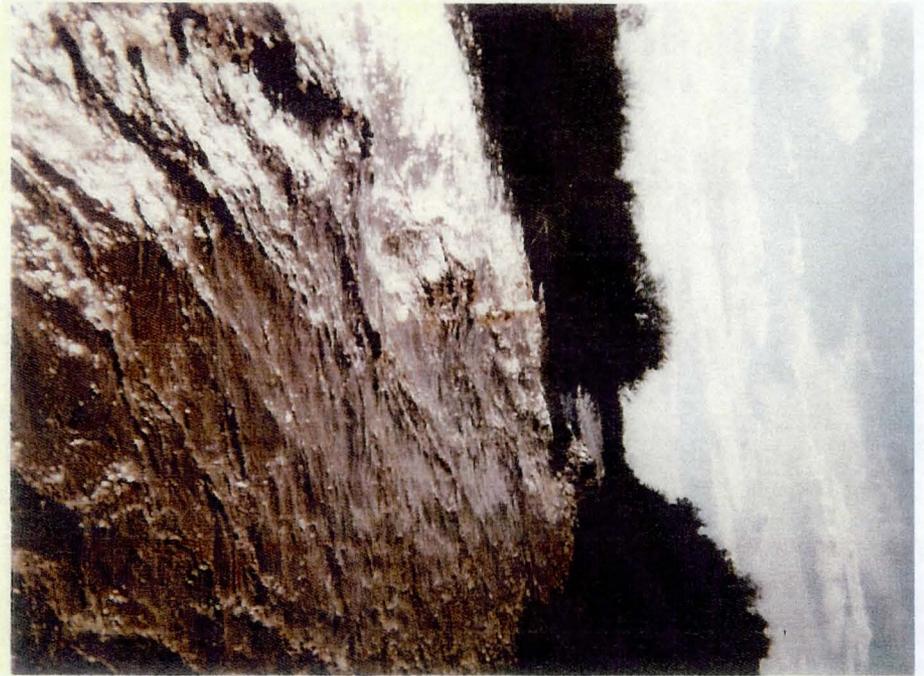
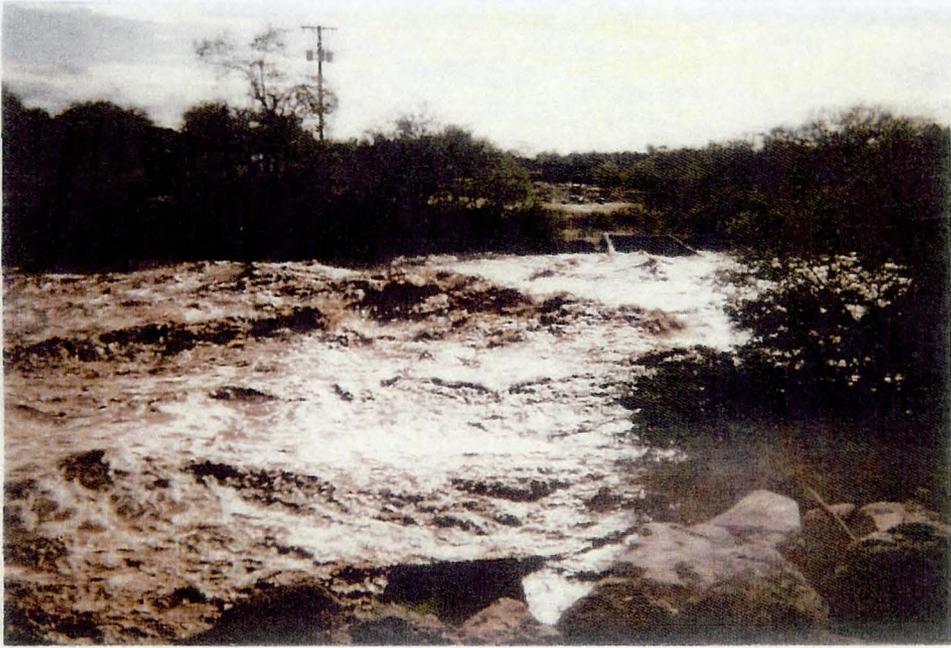
9/6/00 ENG SDW

4th St Look South

165

WICKENBURG, CENTENNIAL

9/6/00 ENG SDW



160

8/29/00
WICKENBURG, CENTENNIAL
Sols Wash @ SR 89
9/6/00 ENG SDW
Looking US @ 1630

159

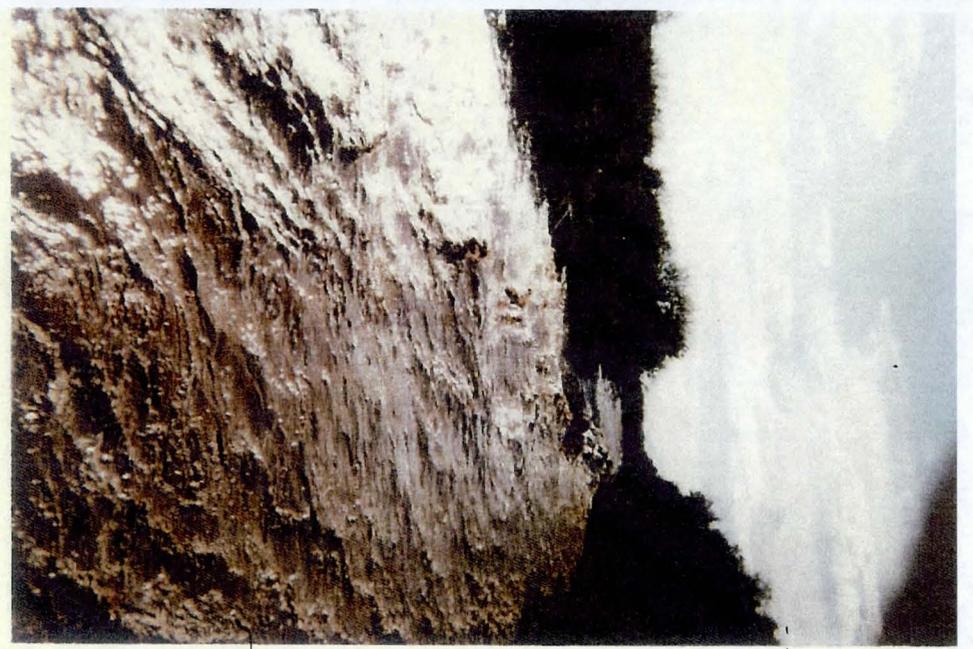
8/29/00
WICKENBURG, CENTENNIAL
Sols Wash @ SR 89
9/6/00 ENG SDW
Looking Upstream 1630

162

8/29/00
WICKENBURG, CENTENNIAL
Sols Wash @ SR 89
9/6/00 ENG SDW
Looking US @ 1630

161

8/29/00
WICKENBURG, CENTENNIAL
9/6/00 ENG SDW 1630
Sols Wash @ SR 89
Looking UP Stream



155

WICKENBURG, CENTENNIAL 8/29/00
Sols Wash at SR 89
9/6/00 ENG SDW

Looking US at 1630

157

8/29/00
WICKENBURG, CENTENNIAL
Sols Wash @ SR 89
9/6/00 ENG SDW

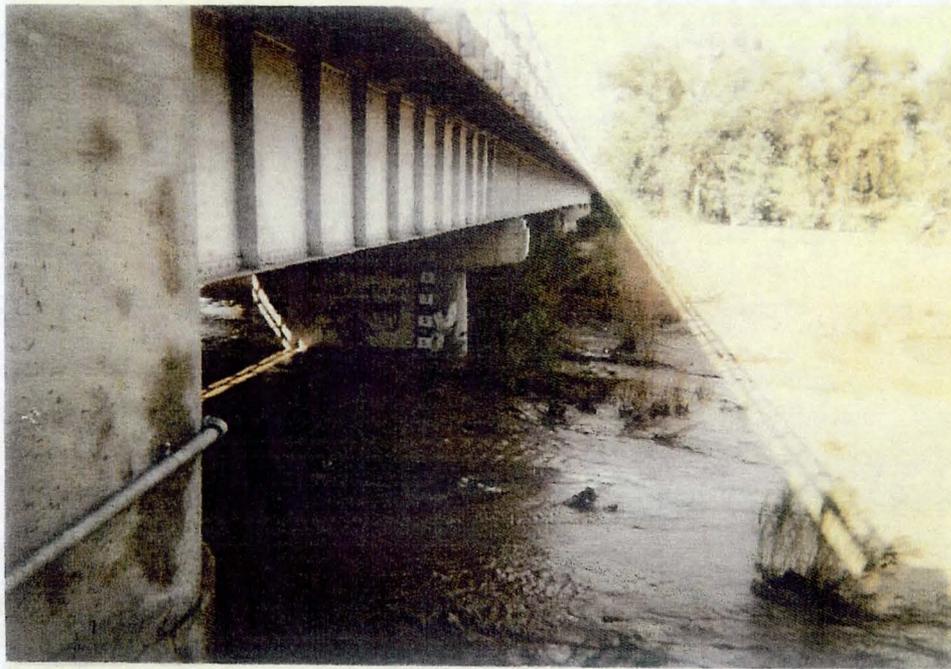
156

WICKENBURG, CENTENNIAL 8/29/00
Sols Wash SR 89
9/6/00 ENG SDW

@1630

158

8/29/00
WICKENBURG, CENTENNIAL
Sols Wash @ SR 89
9/6/00 ENG SDW
@1630



151

8/29/00
WICKENBURG, CENTENNIAL
Sols wasL at SR 89
9/6/00 ENG SDW
@1630

153

8/29/00 @1630
WICKENBURG, CENTENNIAL
Sols wasL @SR 89
9/6/00 ENG SDW
Looking VS

152

8/29/00 1640
WICKENBURG, CENTENNIAL
~~1630~~ Hassy @ US 60
9/6/00 ENG SDW

154

8/29/00
WICKENBURG, CENTENNIAL
1630 Hassy at
9/6/00 ENG SDW
US 60



A.14 Historic Newspaper Articles

Wickenburg Sun

Fill On Sols Wash A Project To Reclaim Lost Land Says Stifel

7-18
-63

A photograph in a recent issue of this newspaper inspired the communication which follows, written on the letterhead of the Flood Control District of Maricopa County, Phoenix, and dated July 10.

"We have noted with interest the picture of Sols Wash in the July 4th issue of your paper, showing the fill opposite Sols Wash Park.

"For your information, and for such action as your paper or members of the community might wish to take, reference is made to Arizona Revised Statutes, Chapter 10, Section 45-2341, Article 4, Special Laws Prescribing Penalties (effective July 14, 1956) which is quoted here:

"A. Whenever it creates a flood hazard in an inhabited area it shall be unlawful for the owner of any creek bed or any other person to deposit debris in such creek bed.

"B. Any person violating the provisions of this section shall be guilty of a misdemeanor punishable by a fine of not less than twenty-five dollars, by imprisonment in the county jail for not less than ten days or both."

(Signed) John C. Lowry,
Chief Engineer & General Manager.

Shown the above letter, Town Manager Reuben Stifel gave this newspaper the following statement:

"Perhaps a few words of explanation in regards to the photograph you published showing what appears to be a public dump in Sols Wash may be in order.

"As you may recall, a few years ago the State Highway Department went to considerable expense in constructing a rail bank protection along the east bank of the Wash. This was done to prevent further erosion and to make possible the reclaiming of a rather wide section of land already lost.

"The town has permitted the dumping of rubble and excess fill dirt behind the steel mesh in hope of preventing any further loss of land. Broken concrete from the construction of our new underpass and rock and gravel from several grading and construction jobs have been dumped in the wash. All of this material has been good fill and will accomplish the purpose for which it was intended.

"Unfortunately some few people have taken advantage of the situation which is almost impossible to keep under constant supervision and have put trash and even garbage in the fill. This we do not condone, and with the help of the Health Department, hope to stop.

With cooperation from citizens living in the area, this land would soon become useful again. Thank you for calling this matter to public attention, for by so doing, the job of policing this project will be much more effective."

Heaviest Downpour In Years Is A Great Treat For Wickenburg

One of the heaviest 24-hour rainfalls since 1951 came to the immediate Wickenburg area the night of Friday, August 16, a downpour that left one and three-quarters of an inch in the Weather Bureau's rain gauge back of The SUN office, caused very little damage from flooding and definitely ended the long drought in this area. With a few light showers which preceeded the Friday storm and another the day following, the total recorded for the period was 1.87 inches, and brought the total for the month to 3.08 inches.

It was a spotty storm. Southwest of town, at the Flying E Ranch, reports said the precipitation Friday night was less than one-tenth of an inch. Northwest on the Prescott Highway Ben McCabe measured only .30 of an inch but the next afternoon, in a 20-minute downpour he measured .62 of an

(Turn to Page 8)

WICKENBURG SUN

8-22-63

①

Aid Sought for Victims Of Flood in Wickenburg

\$100,000 Damage

Surging Waters Race Down Wash

By JAMES C. DOOLEY
Republic Staff Writer

WICKENBURG — Red Cross officials here appealed for emergency aid yesterday for victims of a flash flood Tuesday night which caused damage estimated at \$100,000.

Hardest hit were a home, a trailer park and a motel in the south section of town near the Hassayampa River. No one was injured authorities said.

Nearly a dozen other buildings suffered varying degrees of damage when surging water raced down from Powderhouse Wash and smashed and washed away buildings, automobiles, lawn furniture and personal belongings, leaving a heavy load of silt in its wake.

More than \$25,000 damage was caused at the home of Mr. and Mrs. C. E. Philbeck when a retaining wall collapsed as "wave after wave after wave" of silt-laden water struck their property.

The impact tore away a bedroom wall, and the water washed countless personal belongings away as it raged through rooms and deposited 30 inches of mud on the floors.

Mrs. Philbeck became tearful as she recounted to a reporter how the first wave of muddy water swept away their dog, which they have not seen since.

Mrs. Philbeck said they lost their automobile, garage, beds, lawn furniture, and that they so far have been unable to find any trace of jewelry and silverware.

Last night they stayed with neighbors, but the distraught woman whose husband is ill said, "We don't know what we are going to do or where we are going to live."

A FEW BLOCKS down Constellation Road from the Philbeck home, Herbert Cameron reported \$12,000 damage to his Desert Cyprus Trailer Park, where silt covered large areas of the lawns and roadways. More than 46 trailers were damaged.

Sledgehammer water blows struck the nearby Stage Coach Motor Hotel, damaging 10 of the 13 units beyond repair, causing \$36,000 damage.

Owners Mr. and Mrs. James Vedder said they are going to have to tear all the units down and "begin all over again."

Forty-eight hours after

six feet of water standing in some of the lower motel units. Wickenburg Mayor Sabin E. Brown said the town has had no luck in its appeal of several years ago for a flood control project.

Town officials have asked for a dam at Powderhouse Wash to control runoff.

One of the victims, who said the project "always gets shelved by the Maricopa County Board of Supervisors," said that "maybe this time they'll realize this flood hazard here is real."

The Weather Bureau reported 1.5 inches of rainfall at Wickenburg Tuesday night.

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Storm Causes Heavy Damage

Wickenburg, Ariz. SUN
July 30, 1964 + Page 18

Sunday noon's sudden storm rolling in over Vulture Peak was brief and the rain torrential but it measured, officially, only .30 of an inch in the government rain gauge back of The SUN office.

Nevertheless, the storm caused widespread damage to town streets, water and sewer lines, damage estimated by Town Manager Reuben

Stifel at between \$1,500 and \$2,000. Superintendent of Utilities Coney Crocco had his men out even before the rain stopped and they were still at it late Monday repairing broken water and sewer lines and opening up streets blocked by silt, rocks and debris washed in by the rushing waters.

Almost all sections of town were affected in one way or another, Mr Stifel said, but expressed the belief East Wickenburg, severely damaged in the flood of July 14 fared better in Sunday's storm.

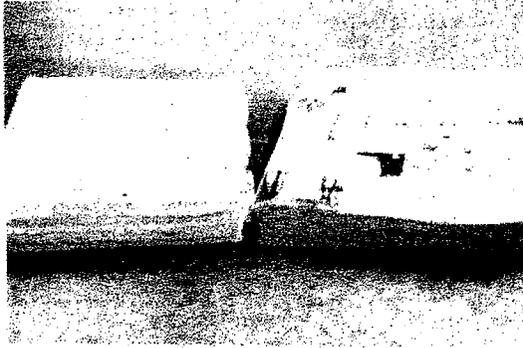
At least one automobile was reported caught in a raging wash south of the California Highway and the interior wrecked. Police had no reports of anyone in jeopardy during the storm but many people returning home from church services had to wait for washes to subside.

The Hassayampa River ran strongly under the bridge, fed by the rain and Martinez and Sols Washes. One group of venturesome young fellows rode inflated inner tubes down the river as far as five miles. It was the first navigation seen on the river in years.

Sunday's rainfall brought the total precipitation for the month as of that date to 2.21 inches

year to 4.07 inches.

Wickenburg Sun 10-1-64
JOHN MCCARROLL'S
HASSAYAMPA
OW-OW-OWLS



Here are two books.

The one on the right is the Phoenix telephone directory. It contains 768 pages, plus cover.

The one on the left is titled: "Flood Control District of Maricopa County." Sub-title: "Flood Control Report Section II Western Maricopa County Hassayampa River Basin Buckeye Water Shed Centennial Wash Bender Wash Sand Tank Wash."

The authors are Johannessen & Girand, Consulting Engineers, Phoenix, Arizona.

The pages are not numbered. We do not have time to count them. You can see for yourself that the book is a little larger than the Phoenix telephone directory.

We quote from the introduction: "This report is submitted . . . in conformance with the engineering study agreement made between the Maricopa County Flood Control District and the firm of Johannessen & Girand Consulting Engineers, Inc. . . ."

We quote further: "The purpose of this engineering study and report was to determine the areas of major damage due to excessive rains and runoff, and to determine the most feasible means by which adequate flood protection could be provided for the areas of concern whereby damages could be minimized or eliminated."

The book is profusely illustrated with maps and charts in support of the engineers' recommendations for measures to protect the residents of this entire area from disastrous floods on Sol's Wash, Martinez Wash, Casandro Wash, Powderhouse Wash and even the Hassayampa River.

The book must represent the expenditure of thousands of taxpayers' dollars.

And yet not ONE SINGLE recommendation of the engineers has been carried out—not even initiated, in fact.

Why not?

May we suggest that, during the next 34 days, you ask those candidates for public office who have been in a position to do something, just why no action has been taken on this matter of such vital importance to all of us living here in

Waters Rise; Two Families Retreat At Wickenburg

9-3-65

Storm waters flowed in the usually dry Salt River at Wickenburg this morning, and occupants of at least two houses were forced to flee as heavy rains hit the area.

The water was running bank to bank at 8 a.m., but receded within a few hours, police reported.

WICKENBURG received .56 of an inch of rain between 8 and 9 p.m. after .72 fell within 30 minutes earlier yesterday.

Police said two houses in Pepperwood Canyon, east of the Wickenburg city limits, were flooded, one to a depth of four feet. A foot of water covered the floor of the other house. Electric power in the area was shut-off to avert danger of elec-

tion shortly before 11 a.m. Observers said chances for rain in the city appeared to be increasing.

Above-average rainfall and below-average temperatures are forecast for Arizona during the next five days.

The weatherman, who expects Phoenix temperatures tomorrow to range between 72 and 94 degrees, said readings across the state will average six degrees or more below normal at least until Wednesday.

Hail is expected to be part of the precipitation picture between McNary and Prescott. Low temperatures forecast for tomorrow include:

McNary, 50; Cottonwood, 60; Kingman, Bisbee and Globe, 62, and Safford, 67.

August Rainfall Table, Page 2

trocation. For a while the water threatened to flood a trailer court.

Heavy thundershowers late yesterday in Lower Oak Creek and the Verde Valley left 1.04 at Cottonwood, .90 at Sedona, and .64 at Prescott Airport, where the 24-hour total was .70.

AT PAYSON, .70 fell between midnight and 1:30 a.m. today to bring the 24 hour total to .95. Flagstaff reported a total of .24 after several light showers.

"Moisture continues to pour into Arizona from the south-west," the weatherman said.

The precipitation is a side effect from tropical storm Emily. The main force of the Pacific-born storm was about 90 miles off the west coast of Baja California today, moving northward at about 3 miles an hour.

TUCSON, with below-average rainfall so far in 1965, received .35 yesterday afternoon. Superior reported .24 this morning.

A light sprinkle was reported at Phoenix Sky Harbor Airport

Fair Weather Starts To Break Up In U.S.

By the Associated Press
The fair weather that covered most of the nation in midweek was breaking up in several areas today.

There were showers in the Central Plains and in the New Mexico-Texas border area.

WEATHER

United States Weather Bureau
Sky Harbor Airport

*Wickenburg Sun
12-16-65*

FLOOD CONTROL DISTRICT 6-66
3325 W. Durango
Phoenix, Ariz. 85009

2 Feet Of Rain, Maybe

Don't Shoot The Weatherman!

—FOR THE YEAR, THAT IS

Will 1965 go down as The Year of the 24-inch—the 2-foot Rain?

It's beginning to look that way.

Last week's downpours, beginning Wednesday and continuing off and on through Saturday measured 2.96 inches in the U. S. Weather Bureau's rain gauge back of The SUN office on North Washington Street.

Added to the 19.40 inches previously recorded for the year to November 30, the total precipitation for the year through Saturday night was a whopping 22.36 inches,

far and away the wettest year in the history of the Weather Bureau volunteer recording station here. Back in 1941 total rainfall measured here was 18.51 inches, the previous record. At times during last week's storm some of the downpours could easily have been classified as near-cloudbursts. Although most washes ran and many streets and roads were washed out—we hear leaky roofs were rather prevalent—material damage from the storm was negligible. Town crews were called out twice to repair water

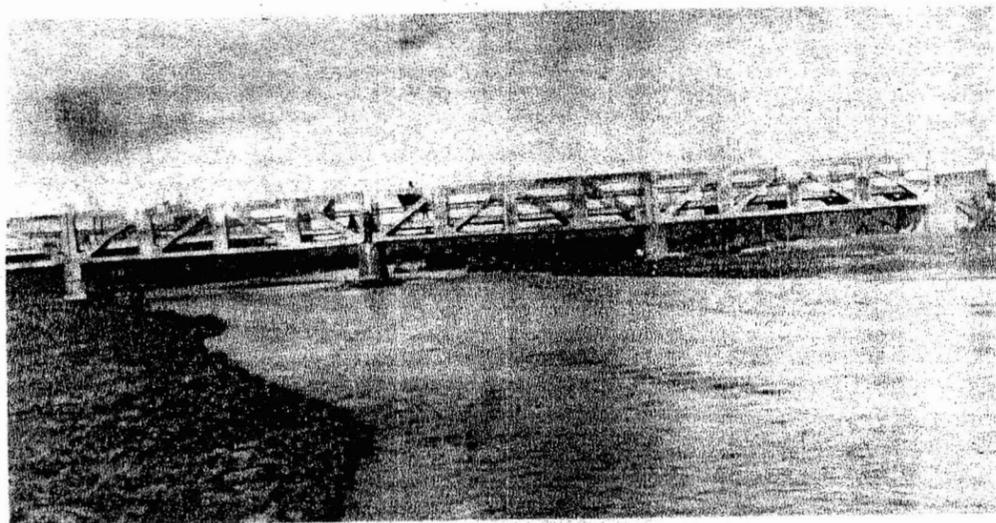
lines severed by rushing flood waters. The Hassayampa ran bank-to-bank for several days but caused little damage other than that in the vicinity of the highway camp, reported elsewhere in this issue.

Although indications pointed to clearing weather Sunday, which could hold throughout the rest of the month, anything can happen, weatherwise, in a wet year like this one. Another 1.64 inches of rain between now and December 31 and 1965 will be referred to as The Year Of The 2-Foot Rain.

Reinforced Concrete

. . . was no match for the

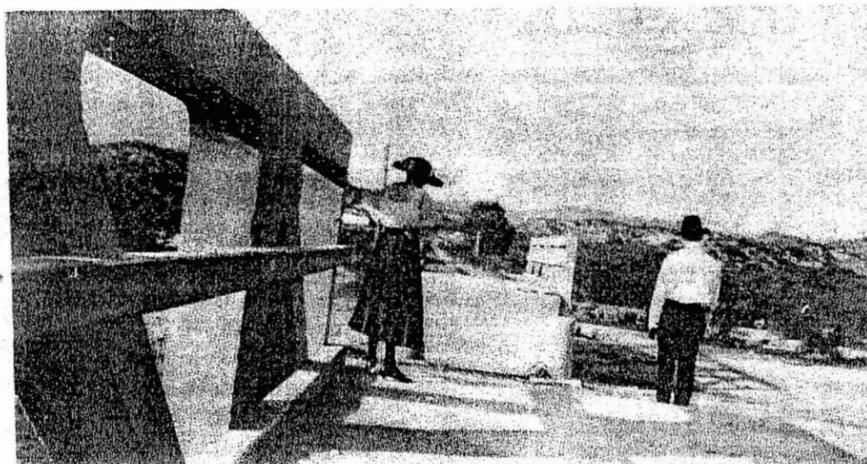
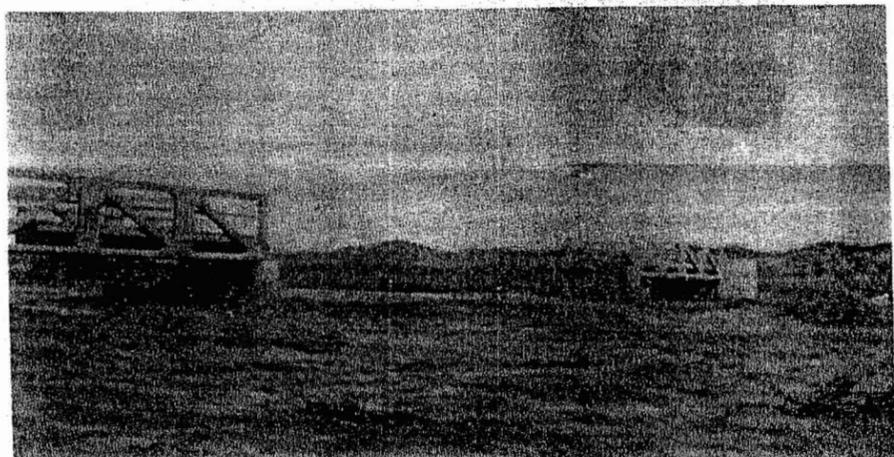
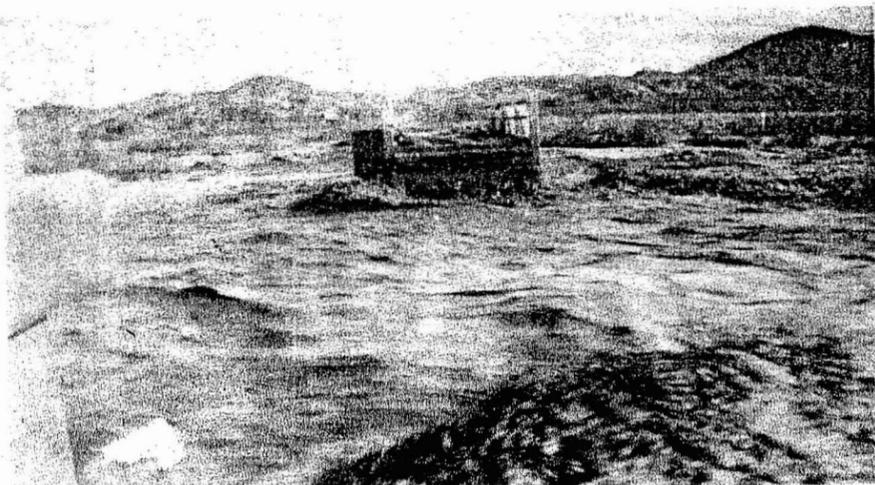
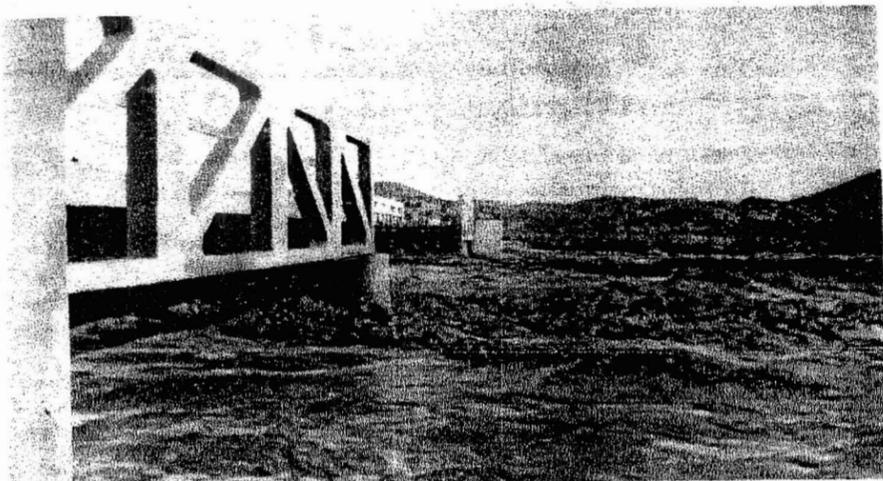
Mighty Hassayampa



PRIDE of the state highway officials and of all the Hassayampa River Valley was the handsome, sturdy reinforced concrete bridge spanning the Hassayampa River at Wickenburg (left.) It was completed in the early months of 1916.

THEN came the summer storms over the Bradshaws and the upper reaches of the Hassayampa, down came the surging, broiling flood waters and out went the entire middle section of the new bridge.

FROM The SUN's files come these old photographs showing the raging waters at the height of the flood and, below, right, two Wickenburgers looking over the wrecked bridge after the flood had subsided.



Flood Control Action Urgent, Planners Say

SIX WASHES POSE A THREAT TO TOWN

Wickenburg should proceed immediately to plan, finance and construct its own flood control projects, declares the Wickenburg General Plan representing a 2-year study of the community.

Paving Project Launched

Fourteen city streets, or portions of streets, are included in the street improvement proposal now being undertaken under the auspices of the Town Council. The first step, the circulating of petitions to property owners involved, is now underway with Mrs Dorothy Thrasher in charge of that endeavor. Fifty-one percent of the property owners involved must sign the petitions in order to complete this first step.

Town Hall officials estimate the cost to adjoining property owners will run approximately \$7.50 per front foot for paving and curbing. That cost, if the venture succeeds, will be spread over 10 years, possibly longer.

Many legal steps involving public hearings, advertising for bids, awarding contracts, etc., will have to be taken before the actual paving of the streets gets underway, assuming of course that all goes well.

Here are the streets which have been incorporated in what Yost & Gardner, the town's engineers, have designated as Improvement District No. 5:

All parts of La Paloma Drive, Avispa Street, Pa-
(Continued on Page 2)

It was made by the Van Cleve Associates, Scottsdale consulting planners and was financed at considerable expense by the Town of Wickenburg with some federal aid.

Obviously, it is up to the Town Council to follow through with the General Plan's recommendations. Local flood control projects will have to be paid for by the town's taxpayers, despite the fact that every property owner in Maricopa County will this year pay 46 cents on every \$100 of assessed valuation for flood control. There has been no indication from the Court House that Wickenburg will get any of this flood control money back, at least for a long time.

We quote, verbatim, from the Van Cleve planners' comment on flood control locally:

The absence of local drainage and flood control measures is a serious local deficiency.

Several major and many minor drainageways flow through town, discharging into the Hassayampa River. A high volume and velocity of floodwater originates in the hilly terrain surrounding the town, and with every violent summer storm, flooding occurs along Sols Wash, Powderhouse Wash, Sunset Wash, Casandro Wash, Sunny Cove Wash and Flying E Wash.

Major corrective measures are required outside the corporate limits.

Although major flooding in Wickenburg can be eliminated only through construction of retention dams beyond the town limits, a general drainage improvement program is seriously needed in town. Drainageways are undedicated, and natural water courses have been filled, blocked and diverted, so that floodwaters flow between lots, across lots, along streets, and occasionally through houses. Clearance of storm-deposited sand, gravel and debris alone is a regular and sizeable public expense.

• Wickenburg should proceed immediately to plan, finance and construct its own flood control projects, giving first priority to improvements within the corporate limits.

• Such a plan should be followed by a long-term construction program which will insure steady progress toward elimination of flooding conditions.

• Meanwhile, the adoption and enforcement of flood
(Continued on Page 2)

FLOOD CONTROL
... from Page 1

plain zoning, based on studies and recommendations already completed by the U. S. Corps of Engineers, will restrict future development in areas where flooding creates danger and undue financial hardship for the general public as well as the individual property owner.

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Wickenburg dam is dedicated

By Brent Whiting
Staff writer

WICKENBURG — Town and Maricopa County officials have dedicated a \$5.2 million dam that will protect residents from floods that have ravaged homes three times in the last 13 years.

Thursday's ceremony marked the completion of the Casandro Wash Dam, an earthen structure and underground storm-drainage system that runs nearly parallel to U.S. 60 in west Wickenburg.

Work on the project began in January as a joint enterprise of Wickenburg and the Maricopa County Flood Control District.

Mayor Dallas "Rusty" Gant, said the dam will protect about 100 homes in the Casandro Wash floodplain and lift federal flood-insurance requirements for area homeowners.

Gant said the project was launched after the town identified the wash area as Wickenburg's top

flooding problem.

Officials said the dam will protect residents from 100-year floods like those that roared through the area in 1976, 1983 and January 1993, the type of flood that has a 1 percent chance of occurring in any year.

The dam is 32 feet high and 350 feet long. It is designed to hold 143 acre-feet of water. An acre-foot, 326,000 gallons, covers an acre of land 1 foot deep.

The dam system also has two storm drains that will carry floodwaters underground to Sols Wash north of the Santa Fe Railway tracks. From there, the water will drain into the Hassayampa River.



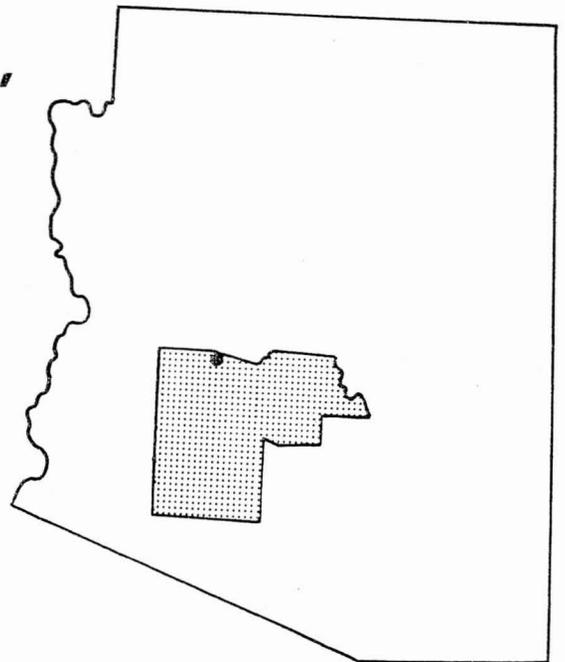
A.15 Flood Control Library Information

FLOOD INSURANCE STUDY



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TOWN OF WICKENBURG,
ARIZONA
MARICOPA COUNTY



HYDRO LIBRARY

JULY 1977

REVISED: 3/29/83



Federal Emergency Management Agency

COMMUNITY NUMBER - 040056

FFMA

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Flood Insurance Study, Town Of Wickenburg
FCDMC call number : A038.015.001

Date:

1977, Revised 3-29-83 (FIS)

Description:

Investigates the existence and severity of floods in the town of Wickenburg. Information on this report will aid in converting Wickenburg to a regular program of Flood Insurance by FIA, and will promote sound land use and flood plain development.

Type of Data:

Contains summary of peak discharges (10-50-100-500), flooding data, and flood insurance zone data for the Hassyampa River, and the Sols, Flying "E", Casandro, South Branch Casandro, Hospital and Powder house washes. There are also flood profiles for the 10-50-100-500 year flood on the Hassyampa River, approximately one mile upstream and downstream of the SR-93 bridge.

FLOOD PLAIN INFORMATION

HYDRO LIBRARY HASSAYAMPA RIVER VICINITY OF WICKENBURG ARIZONA

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PREPARED FOR
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA

BY
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA

APRIL 1972

07.-1-00-8-04/72

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Flood Plain Information, Hassayampa River- Vicinity of Wickenburg
FCDMC call number: A343.014.002

Date:

1972

Description:

Presents information on the flood hazards along the Hassayampa river in Wickenburg and surrounding areas.

Type of Data:

Information that indicates that floods greater than those in the past can reasonably be expected in the future. Includes photographs marking the height of possible future floods at different locations within the city of Wickenburg.

Rainfall and runoff characteristics plus streamgaging data as primary basis for determining the size of future floods.

Photos of the Hassayampa River at hwy 93 bridge.

Table with historical peak flows.

Experts from the Arizona Republic and the Wickenburg Sun on the 1970 flood.

Photos of the 1970 flood.

Maps of flooded areas.

Flood profiles for the Standard Project Flood and the Intermediate Regional Flood approximately seven miles upstream and seven miles downstream from the city of Wickenburg. Includes several cross sections and Stage Hydrograph @ river mile 48 (close to the hwy 93 bridge).

TOWN OF WICKENBURG, CELLA BARR ASSOCIATES STUDY
 *****BACKWATER ANALYSIS*****

Q VALUES FOR SOLS WASH (CONFLUENCE WITH HASSAYAMPA RIVER TO RIVER MILE 9.25)

<u>CROSS SECTION</u>	<u>10-YEAR Q</u>	<u>50-YEAR Q</u>	<u>100-YEAR Q</u>	<u>500-YEAR</u>
.03*	7019	12453	15045	20836
.60**	6748	11964	14459	20005
.68	6725	11927	14413	19986
2.06	5784	10433	12945	18691
2.78	5100	10212	12817	18518
3.27	4906	9954	12464	18037
4.31	4798	9767	12244	17749
4.98	4736	9661	12118	17583
5.35	4081	8274	10370	15075
8.48	3867	7861	9862	14378
8.75	3696	7504	9419	13760
8.86	3258	6626	8325	12252
9.25 (END OF STUDY)				

* FIRST CROSS SECTION FROM THE CONFLUENCE.
 ** CONFLUENCE OF BRAIDED CHANNELS.

Q VALUES FOR SOLS WASH (CONFLUENCE WITH HASSAYAMPA RIVER TO RIVER MILE 9.25)

A342.707

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

“Q” Values for Sols Wash (Confluence with the Hassayampa River, Mile 9.25)

FCDMC call number: A343.707

Date:

1986

Description:

Backwater analysis done by Cella Bar & Associates for the town of Wickenburg.

Type of Data:

Report consists of computer output for the backwater analysis and contains a table that summarizes the “Q” values for 10y-50y-100y and 500y events.

Lower Hassayampa River Watercourse Master Plan
Hydrology Report

February
2005



Lower Hassayampa River Watercourse Master Plan

Hydrology Report

February 2005

Submitted to:
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Submitted by:
JE Fuller/Hydrology & Geomorphology, Inc.
8400 S. Kyrene Road, Suite 201
Tempe, AZ 85284

A346.701

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Lower Hassayampa River Watercourse master plan, Hydrology Report
FCDMC call number: A346.701

Date:

February 2005

Description:

Report describes methods and results of the hydrologic analyses performed for the lower Hassayampa River Watercourse Master Plan. Analyses were performed for the entire Hassayampa River watershed. Reach is from approximately the Central Arizona Project Canal to the confluence of the Gila River.

Type of Data:

Estimated peak discharges for multiple frequencies and a design hydrograph for the 100-year flood event in the study reach. Peak discharges also for Jackrabbit Wash, tributary to the Hassayampa. Results compared to previous analyses and recommendations made.

Tables showing flood frequency results for the 2 through 100 year floods. Tables with flood frequency statistics for the Hassayampa at different stations.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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COMPILATION OF
FLOOD DATA IN ARIZONA
1862—1953

By Winchell Smith and Wilbur L. Heckler

Prepared in cooperation with the
ARIZONA STATE LAND DEPARTMENT

Roger Ernst, Commissioner

Open-file report

Tucson, Arizona

August 1955

803.001

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Compilation of Flood Data in Arizona, 1862-1953
FCDMC call number: 803.001

Date:

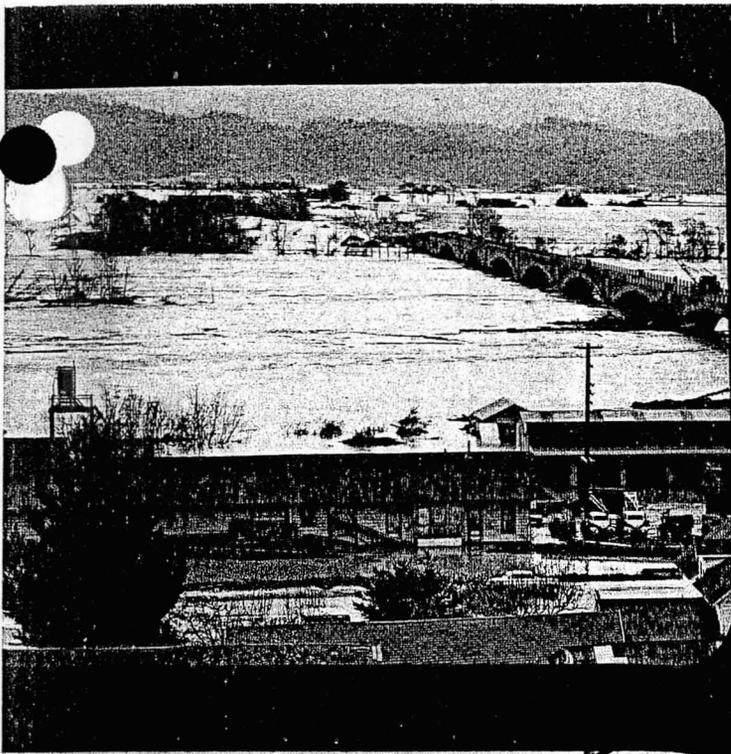
1955

Description:

Historic flood data for different rivers, streams, including the Hassayampa..

Type of Data:

Tables for gaging-station records for the Hassayampa River near Wagoner AZ, at Box dam site, near Wickenburg, and near Morrison town. They show annual peak stages and discharges for dates between 1938 and 1942.



ENGINEERING DIVISION

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GUIDELINES FOR FLOOD DAMAGE REDUCTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

203.002

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Guidelines for Flood Damage Reduction
FCDMC call number: 203.002

Date:

1976

Description:

Presents methods of reducing flood damage through preventive and corrective measures. Study presented by Corps of Engineers.

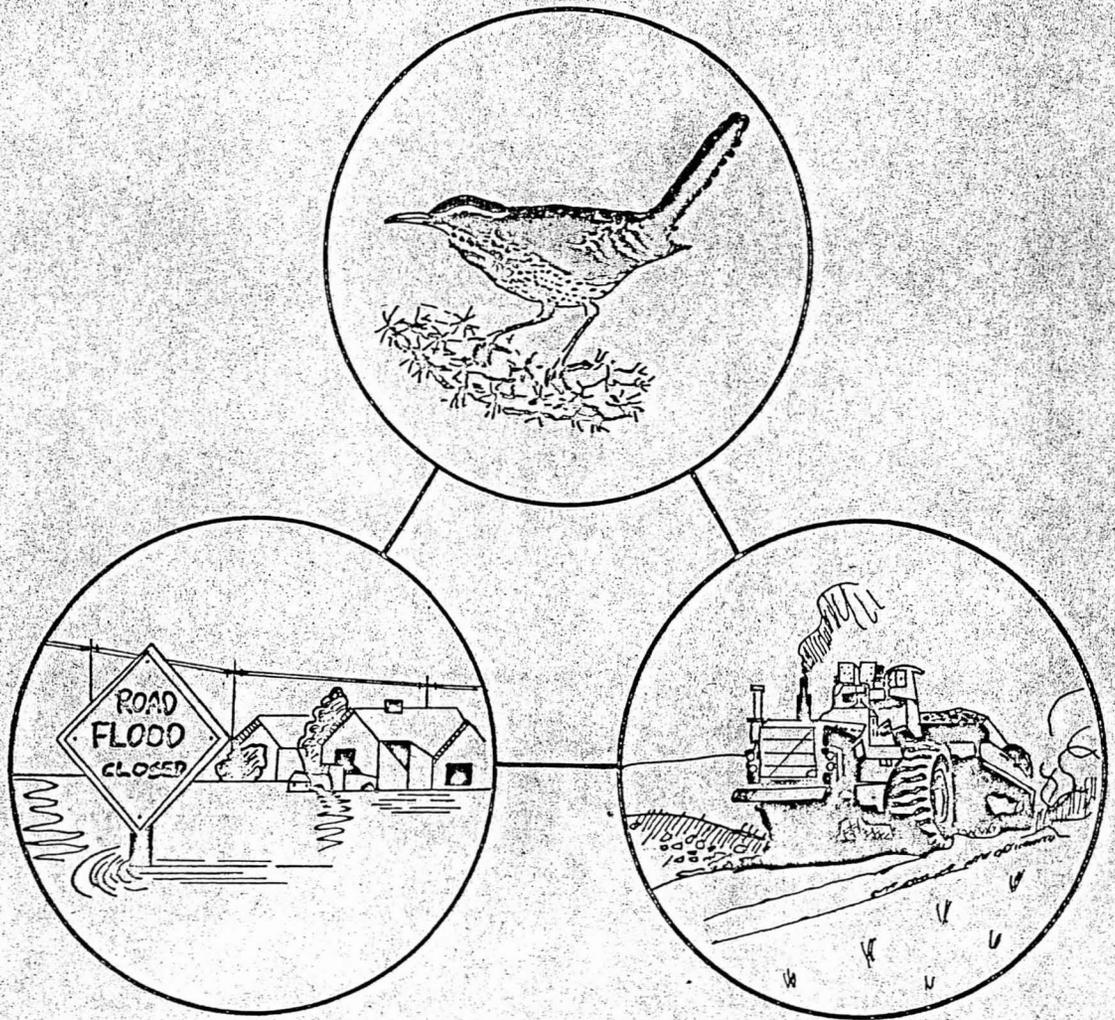
Type of Data:

Chart showing relationship of flood-plain-information studies to both preventive and corrective measures.

Major Drainage Areas Hydrologic map, Wickenburg report.

Maps with Index of Flood Areas, Points of Concentration Frequencies-Study Reaches, Stream names and Local Drainage areas, Flood Area Powder House Wash.

U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
**ENVIRONMENTAL ASSESSMENT
 REPORT**
 WICKENBURG WATERSHED PROJECT
 MARICOPA & YAVAPAI COUNTIES
 ARIZONA



SPONSORING LOCAL ORGANIZATIONS

- WICKENBURG NATURAL RESOURCE CONSERVATION DISTRICT
- TRIANGLE NATURAL RESOURCE CONSERVATION DISTRICT
- YAVAPAI COUNTY BOARD OF SUPERVISORS
- FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
- TOWN OF WICKENBURG

A343.905

HASSAYAMPA POST-FLOOD STUDY
Flood Control Library Information

Name:

Environmental Assesment Report, Wickenburg Watershed Project,
Maricopa and Yavapai Counties, Arizona.
FCDMC call number: 803.001

Date:

1973

Description:

With the objectives of watershed protection and flood prevention, the sponsors of the Wickenburg Watershed project propose to provide up to and including 100-year frequency flood protection for developed areas along the Sunset-Sunnycove Wash and to stabilize critical erosion areas.

Type of Data:

Presents land treatment, land use changes, structural and non-structural measures. Describes among other, physical, economic resources, and soil, water and plant management status. Also land and water management, as well as direct and indirect floodwater and sediment damages including estimated damages in the event of the 100-year storm.

Regarding environmental impacts, it mentions the estimated sediment delivered annually to the Hassayampa by the watershed washes, and how the land treatment program will reduce the average annual sediment.



A.16 CD