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Draft Proposal

Bed Scour or Fill Monitoring For Bank Stabilized Channels in Maricopa County

By Russ Cruff for Flood Control District of Maricopa County

1997

MEMORANDUM

DATE: MAY 1, 1997

TO: JOE TRAM

FROM: RUSS CRUFF

SUBJECT: BED SCOUR OR FILL MONITORING

Enclosed are three(3) draft proposals. They are located on the computer G drive:
G:\RWC\PROJECTS\BANK-MON.

1.- The first one is PROPA.WPD, and is for setting and surveying from Brass Tablets only.

2.- The second one is PROPB.WPD, and is for setting Brass Tablets and surveying 300 feet of cross section at each.

3.- The third one is PROPOSAL.WPD, and is for setting Brass Tablets, Rods, and surveying 300 feet of cross section at each site. It is the one that we had prepared before the meeting yesterday.

I would recommend that we begin with number 1 or 2, with the goal being to eventually add the rods and bring the program up to that of number 3. If access along the top is not readily possible for vehicles at the level of the brass tablets or if it is too far horizontally from the brass tablet to the toe of the bank, it may be that the monitoring, after the initial survey, is going to be difficult in many areas without the rods to measure from. The advantage of the rods is that a person can drive, or walk, if necessary, along the toe of the bank and measure from the rods to the bed.

RUSS

DRAFT PROPOSAL
(Brass Tablets, Rods, and Cross Sections)
FILE = PROPOSAL.WPD

**BED SCOUR OR FILL MONITORING
FOR
BANK STABILIZED CHANNELS IN MARICOPA COUNTY**

PROBLEM: Scour has eroded below the toe down of the bank stabilization in places along the channelized portions of the Salt River. This, if allowed to continue could cause the failure of the bank protection. Thus, a method is needed to detect the areas where scour is occurring before it can cause bank failure not only on the Salt River, but, also on all other areas where bank stabilization has been placed in Maricopa County.

PURPOSE: The purpose of this proposal is to develop a method, by which we can monitor the amount of scour or fill along the stabilized banks of the rivers and other channels in Maricopa County. The monitoring would be done after each major flow event. The results of the monitoring would then be used to determine if any action is required to prevent damage to the banks.

MONITORING AREA: All flood control structures, with bank stabilization and movable beds, depicted in Figure 1 attached would be considered for monitoring. Some of these are:

SALT RIVER: There are several reaches of the Salt River between Alma School Road and 19th Avenue that presently need to be considered for monitoring.

1. The primary reach is about 5.5 miles of the river from above McClintock Drive to near 40th Street. This is the reach covered by the Rio Salado and the Hohokam Freeway projects.
- 2 The reach upstream from McClintock Drive for about 3 mile to Dobson Road may also have bank stabilization due to the Highway construction and require monitoring.
3. The reach from 40th Street to I-10 may also have some stretches that need monitoring.
- 4.The reach above 19th Avenue for about 3/4 of a mile should also be monitored.
5. There is a short stretch at the landfill on the north bank, west of Alma School Road that may need monitoring.

NEW RIVER: The New River between the Agua Fria River and Skunk Creek has bank stabilization and should be monitored.

AGUA FRIA RIVER: The Agua Fria river from the Gila river to about Indian School Road also needs to the have bank stabilization monitored.

OTHER: Any other reach of channel that has bank stabilization installed in the future, should be added to the monitoring program.

USE OF RESULTS: The information would be used to determine the rate of scour or fill along the banks of the channel. The information would then be used to determine if and when maintenance procedures must be performed to maintain the integrity of the structures.

MONITORING: The proposal would include setting permanent markers along the bank of the study reaches. It also would include a survey of the markers and a method for follow up surveys. The markers would be used to measure the elevation of the bed along the banks. They would be set and the bed elevations determined, per specifications in the following sections. Specifications for future monitoring from these markers are also described. The follow up monitoring would be performed after every major flow event and a profile and cross sections of the bed elevations plotted. The profile and cross sections would be used to compare the results with previous profiles and cross sections information, thus, determining changes with time.

PERMANENT MARKERS:

INSTALLATION: See Figure 2 for a diagram of the following description. Brass tablets would be located along the top of the bank at about 1,000 foot intervals with station numbers stamped on the tablets. The stationing for this should be the same as that used for design and construction along the river. The first choice would be to set the brass tablet into the soil cement. If this is done a 1 1/2 inch by 1 foot deep hole should be drilled and the tablet epoxied into the hole. The brass tablet should be set as flush as possible to the concrete at the top of the channel bank, not too close to the edge, and located in a stable area out of the main path of any vehicle traffic.

The second choice would be to set the brass tablet in the dirt bank. If this is done a steel round or square pipe 1.5 to 3 feet long, would be driven into the ground with the brass tablet epoxied into the top of the pipe. They should be set so that the top of the brass tablet is about even with the ground level on the top of the channel bank and located in a stable area out of the main path of any vehicle traffic.

Two 1/2 inch diameter six foot long steel rods will be located in the channel wall directly below the brass tablet. These rods will have caps or nuts welded to one end. The rods will be located such that "A" is set approximately 4 feet in elevation above the bed and "B" would be set near the stream bed. The wall would be drilled horizontally and the rods epoxied into the soil cement with only the nut or cap protruding. They are to be set with "A" and "B" in a direct vertical line below the brass tablet.

SURVEY: After the brass tablet markers are installed, a vertical and horizontal survey shall be made. The vertical datum is to be tied to that used in the design of the structure and to the latest base used for local topographic mapping. The horizontal survey will be based on a beginning setting to magnetic north = 0 degrees 0 minutes. The elevations of each of the markers, the stationing of the markers, and the horizontal relationship between brass tablets will be determined. All existing reference points along and near the structure should also be included in the survey. Then from each brass tablet set along the bank, the elevation and horizontal angle of the top of the protruding ends of the nut or cap on the ½ inch rods will be surveyed. The horizontal distance from the brass tablet to the rods will also be measured. Also at this time the bank elevation is to be determined at the top and at the channel bed, as well as other points that may be necessary. The horizontal distance from the brass tablet to the measurement points should also be measured. These elevations and distances will be used to determine the slope of the bank. The elevations of the channel bed are to be surveyed for 300 feet into the channel perpendicular to the bank, the brass tablet and rods "A" and "B". This will be done at 10 foot intervals, beginning at the lower edge of the bank, below the brass tablet and the ½ inch steel rods. The horizontal angle of the survey of the channel bed also must be determined for future reference. The results of the survey are to be summarized in a form that makes it readily useable for follow up surveys.

FUTURE MONITORING: To use the markers for future monitoring a person should travel along the study reach and at each brass tablet marker, measure the distance from the top of the cap or nut on one of the ½ inch steel rods to the bed along the side wall. This distance would be measured on the angle of the slope of the side wall and the designation of the rod (A or B) from which the measurement was made noted. The bed elevation would then be determined from the elevation of the pin used and the slope of the wall.

The bed elevations will then be used to develop a profile of the bed elevation along the reach. A comparison of this profile with previous profiles would determine the changes in scour or fill along the channel.

Also, at all cross sections, the rods need to be inspected to see if there has been scour of the soil cement. This would be done by determining if the cap or nut on the end of the rod is still flush with the wall. If it is not, the amount of rod protruding to the cap or nut will be measured.

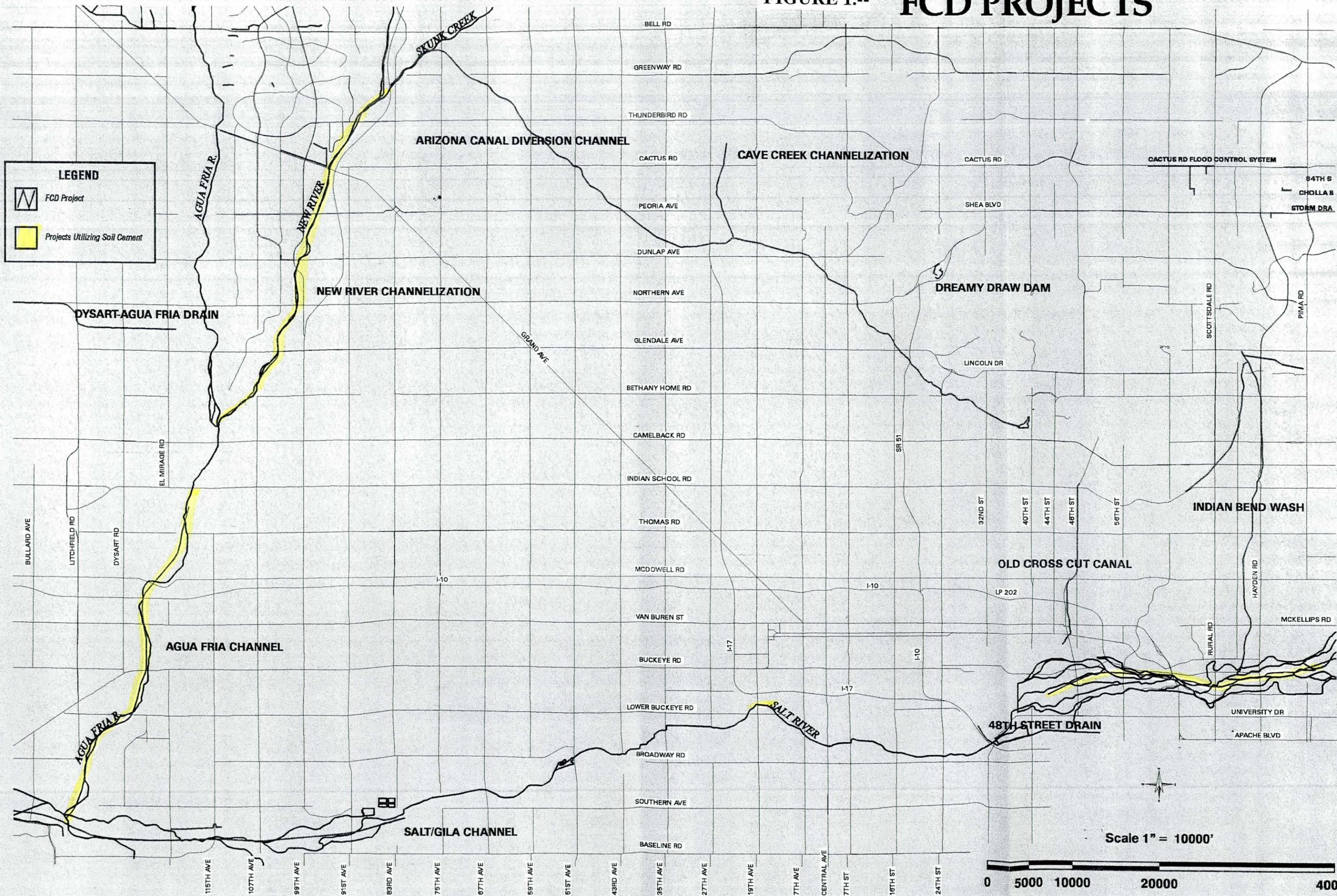
Upon completion of the monitoring, the results shall be presented to the Chief of the Engineering Division for review. If the changes are significant a resurvey of the 300 feet of the bed would be requested for selected cross sections. The survey is to be begun by setting over the brass tablet at the section. The height of the instrument will be determined from a tape up from the brass tablet plus a check shot on one of the adjacent brass tablets. The horizontal angle is to be set from the shot on the adjacent brass tablet. These elevations and angles as well as the angle for the cross section would have been determined in the original survey and should be easy to determine from the summary that was prepared from the original survey.

The data from the bed profile and the new cross section surveys, will be entered into a data base via the GIS system, and tied to the structure, for future purposes. This information will then be used by the Engineering Division personnel, to determine if any further action is required to protect the bank from possible failure.

R.W. Cruff, P.E.
April 24, 1997

FIGURE 1.-- FCD PROJECTS

PRELIMINARY



/udd/adm.gc/projects/Item/fcdproj.aml.02/25/97.18:55:03.1ue



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT BED FILL OR SCOUR MONITORING PAGE OF
DETAIL LOCATION OF MARKERS COMPUTED RWC DATE 4-22-97
CHECKED BY DATE

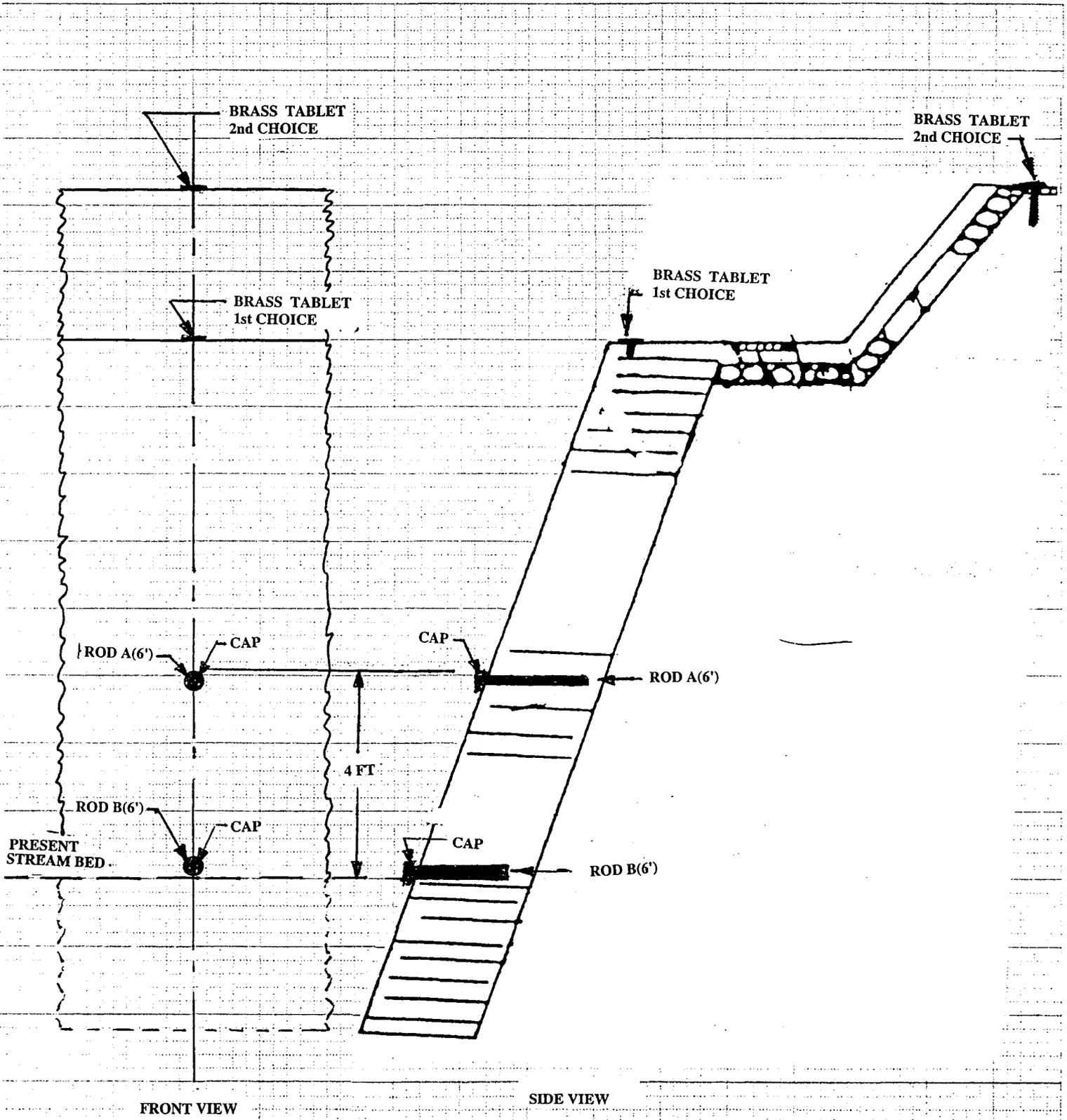


FIGURE 2.--DIAGRAM SHOWING MARKER INSTALLATION.

DRAFT PROPOSAL

(Brass Tablets and Cross Sections)

FILE = PROPB.WPD

BED SCOUR OR FILL MONITORING FOR BANK STABILIZED CHANNELS IN MARICOPA COUNTY

PROBLEM: Scour has eroded below the toe down of the bank stabilization in places along the channelized portions of the Salt River. This, if allowed to continue could cause the failure of the bank protection. Thus, a method is needed to detect the areas where scour is occurring before it can cause bank failure not only on the Salt River, but, also on all other areas where bank stabilization has been placed in Maricopa County.

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OTHER: Any other reach of channel that has bank stabilization installed in the future, should be added to the monitoring program.

USE OF RESULTS: The information would be used to determine the rate of scour or fill along the banks of the channel. The information would then be used to determine if and when maintenance procedures must be performed to maintain the integrity of the structures

MONITORING: The proposal would include setting permanent markers along the bank of the study reaches. It also would include a survey of the markers and a method for follow up surveys. The markers would be used to measure the elevation of the bed along the banks. They would be set and the bed elevations determined, per specifications in the following sections. Specifications for future monitoring from these markers are also described. The follow up monitoring would be performed after every major flow event and a profile and cross sections of the bed elevations plotted. The profile and cross sections would be used to compare the results with previous profiles and cross sections information, thus, determining changes with time.

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SURVEY: After the brass tablet markers are installed, a vertical survey shall be made. The vertical datum is to be tied to that used in the design of the structure and to the latest base used for local topographic mapping. The elevations and stationing of each of the brass tablets will be determined. All existing reference points along and near the structure should also be included in the survey. The elevations of the channel bed are to be surveyed for 300 feet into the channel perpendicular to the bank. This will be done at 20 foot intervals, beginning at the lower edge of the bank, below the brass tablet. The results of the survey are to be summarized in a form that makes it readily useable for follow up surveys.

FUTURE MONITORING: To use the markers for future monitoring a person should travel along the study reach and at each brass tablet marker, measure the distance from the top of the brass tablet to the channel bed. The bed elevation would then be determined from the elevation of the known elevation of the brass tablet and the distance to the bed. These bed elevations will then be used to develop a profile of the bed elevation along the reach. A comparison of this profile with previous profiles would determine the changes in scour or fill along the channel.

Upon completion of the monitoring, the results shall be presented to the Chief of the Engineering Division for review. If the changes are significant a resurvey of the 300 feet of the bed would be requested for selected cross sections. The survey is to be begun by setting over the brass tablet at the section and the height of the instrument will be determined from a tape up from the brass tablet. These elevation for the brass tablet would have been determined in the original survey and should be easy to determine from the summary that was prepared from the original survey. The cross section will be resurveyed for 300 feet, at 20 foot increments, perpendicular to the bank, the same as was done in the original survey.

The data from the bed profile and the new cross section surveys, will be entered into a data base via the GIS system, and tied to the structure, for future purposes. This information will then be used by the Engineering Division personnel, to determine if any further action is required to protect the bank from possible failure.

R.W. Cruff, P.E.
May 1, 1997

FIGURE 1.-- FCD PROJECTS

PRELIMINARY



/add/adm.gc/projects/1rom/lcdproj.om.02/25/97.18.55.03.Tue

DRAFT PROPOSAL

(Brass Tablets)
FILE = PROPA.WPD

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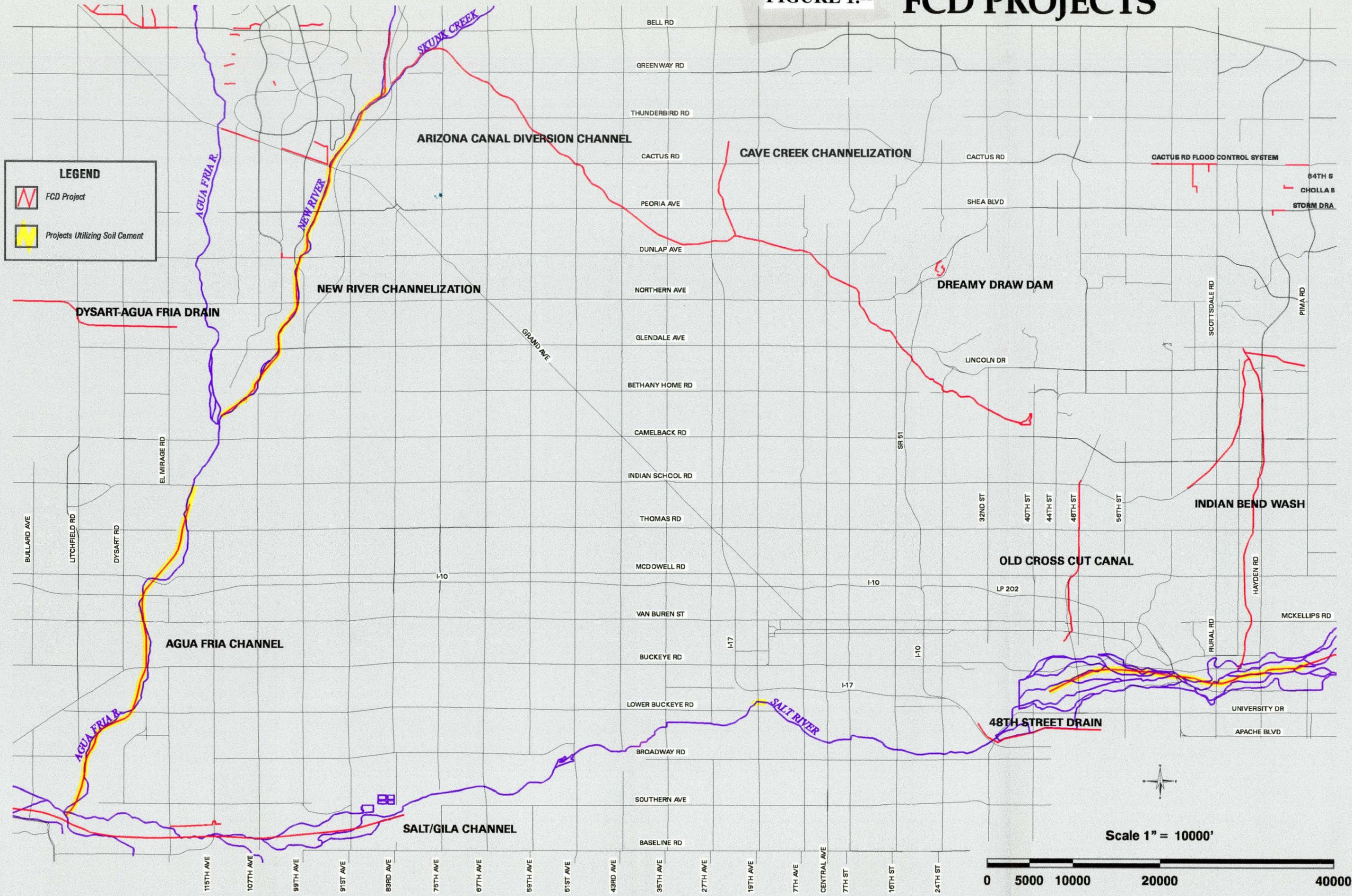
FUTURE MONITORING: To use the markers for future monitoring a person should travel along the study reach and at each brass tablet, measure the difference in elevation between the brass tablet and the bed at the toe of the bank. These differences would then be used with the elevation of the brass tablet to determine bed elevation at the site.

The bed elevations will then be used to develop a profile of the bed elevation along the reach. A comparison of this profile with previous profiles would determine the changes in scour or fill along the channel.

Upon completion of the monitoring, the results shall be presented to the Chief of the Engineering Division for review. The data from the bed profile surveys, will be entered into a data base via the GIS system, and tied to the structure, for future purposes. This information will then be used by the Engineering Division personnel, to determine if any further action is required to protect the bank from possible failure.

R.W. Cruff, P.E.
April 30, 1997

FIGURE 1.-- FCD PROJECTS



LEGEND

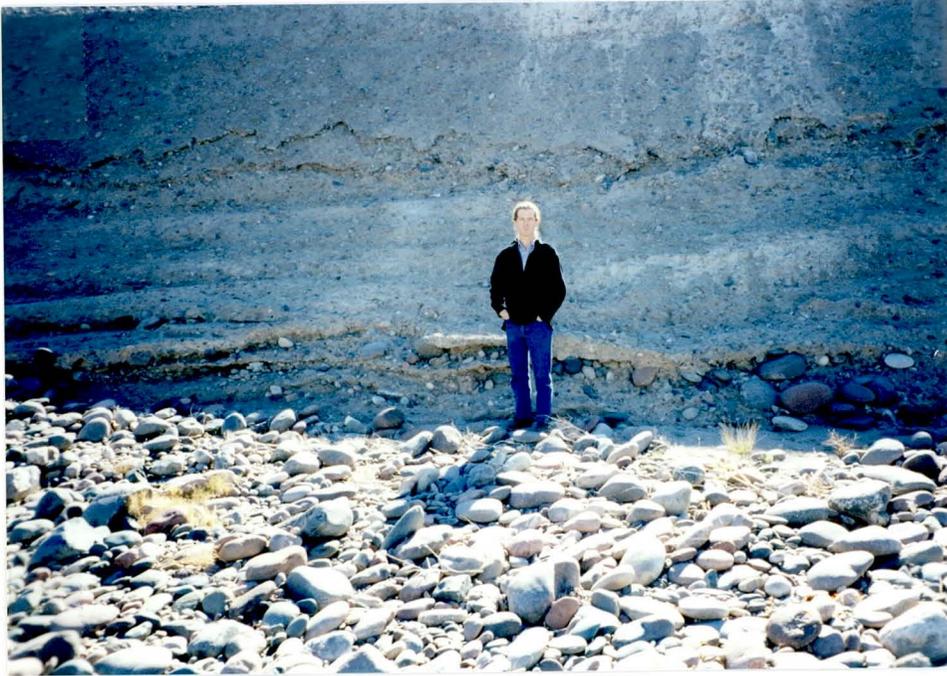
- FCD Project
- Projects Utilizing Soil Cement

PRELIMINARY

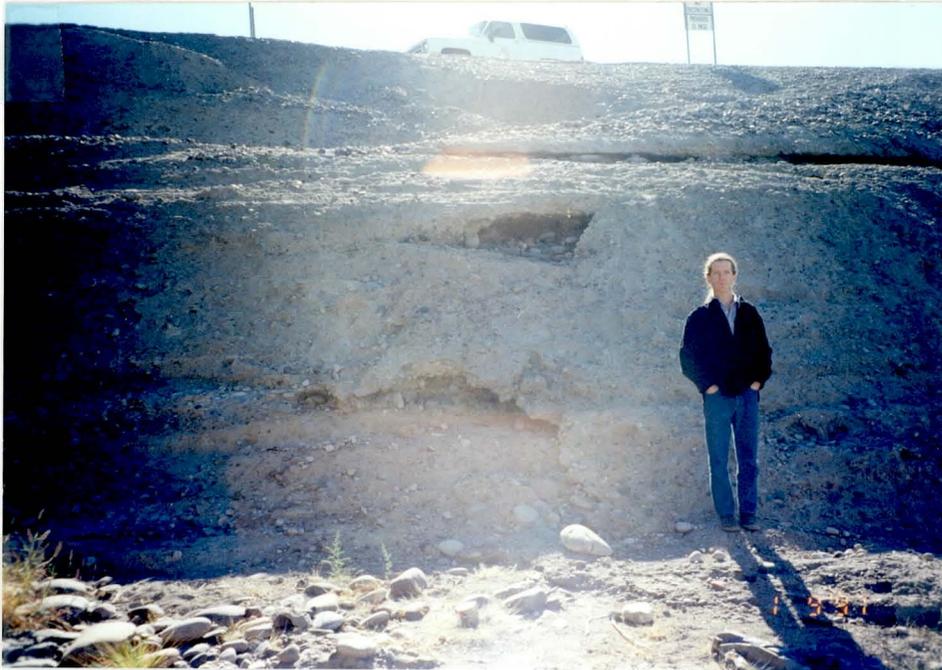
/udd/odm_gsc/projects/11com/fcdproj.sml_02/25/97.18:55:03.jpg

Scale 1" = 10000'

Salt River at Priest Road



Looking at the south bank about 20 feet below the bridge.



Looking at the south bank about 200 feet below the bridge.

Salt River below McClintock Drive



Looking downstream at the scour hole along south bank.



Looking downstream at the upper end of the scour hole along the south bank.

Salt River below McClintock Drive



Looking downstream at the center of the scour hole along south bank.

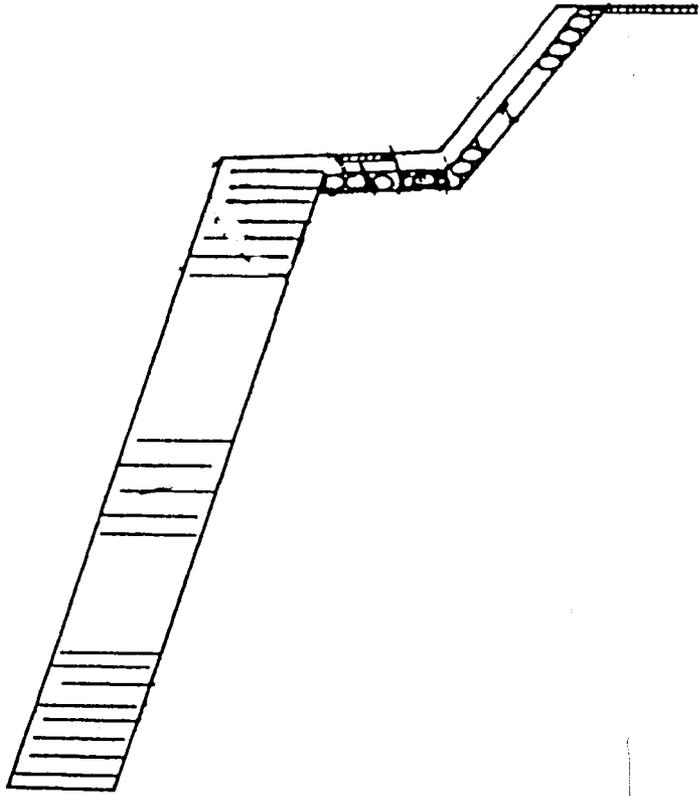


Looking downstream from the lower end of the scour hole along the south bank.

Salt River at Priest Road



Scour at the bridge pier.





19th Ave Br.
1911

channel alignment
17th Hottokan
Sky Harbor

RIO SALADO
T-04

SEE ENLARGEMENT
ON PAGE B

landfill